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DEPARTMENT OF THE INTERIOR

BULLETIN

OF THE

UNITED STATES

GEOLOGICAL SURVEY

No. 169

WASHINGTON
GOVERNMENT PRINTING OFFICE
1900

4. M. W. 13/7

UNITED STATES GEOLOGICAL SURVEY

CHARLES D. WALCOTT, DIRECTOR

ALTITUDES IN ALASKA

COMPILED BY

HENRY GANNETT

WASHINGTON
GOVERNMENT PRINTING OFFICE
1900

LETTER OF TRANSMITTAL.

Department of the Interior,
United States Geological Survey,
Washington, D. C., February 5, 1900.

Sir: I have the honor to transmit herewith, for publication as a bulletin, a list of altitudes in Alaska, drawn mainly from the charts and other publications of the United States Coast and Geodetic Survey and the publications of this office.

Very respectfully,

Henry Gannett,
Geographer.

Hon. C. D. Walcott,
Director United States Geological Survey.

ALTITUDES IN ALASKA.

BY HENRY GANNETT.

Locality.	Authority.	Elevation.
		Feet.
Achilles Mountain	U. S. Coast and Geodetic Survey.	3,027
Adakh Island	do	5,678
Adams Mountains	do	7,600
Agassiz Mountain	do	2,241
Agassiz Peak	do	5,931
Aghik Island (Semidi Islands)	do	250
Aghiyuk Island (Semidi Islands)	do	1,500
Akutan Island (Fox Islands)	do	3,888
Alikhsemit Island (Semidi Islands)	do	300
Amagat Island	do	1,900
Amak Island	do	1,682
Amatignak Island	do	1,921
Ambler Peak	do	3,058
Amlia Island	do	1,900
Amukta Island	do	3,738
Ancon Peak (Woronkofski Island)	do	3,300
Anowik Island (Semidi Islands)	do	650
Anvil Mountain (Annette Island)	do	2,157
Arkell Lake	do	2,700
Arm Mountain	do	2,177
Arthur Peak	do	3,434
Atka Island	do	4,988
Augustine Island	do	[1]3,000
Avatanak (Fox Islands)	do	1,207
Bainbridge Peak	do	3,467
Bald Ridge (Annette Island)	do	2,241
Barlow Mountain (Mansfield Peninsula)	do	2,142
Bay Point Knoll	do	2,108
Beauclerc Peak	do	2,500
Behm Mountain	do	2,867
Bell Island	do	2,500
Bence Mountain	U. S. Geological Survey	4,800
Berry Knoll	U. S. Coast and Geodetic Survey.	894
Berry Peak (Wrangell Island)	do	2,500
Bessie Peak	do	4,130
Between Mountain	do	1,526
Big Diomede Island (Bering Strait)	do	1,759
Big Mountain	do	8,750
Blackburn, Mount	do	12,500
Black Crag	do	5,895
Black Mountain	do	1,883
Black Mountain	do	5,130
Black, Mount	do	12,500
Black Thorn	do	4,010

[1] Approximate.

Locality.	Authority.	Elevation.
		Feet.
Bobrof Island	U. S. Coast and Geodetic Survey.	1,392
Bohemian Range	do	2,144 2,589 1,784
Boundary Mountain	do	4,805
Buldir Island	do	1,145
Butler Peak	do	1,153
Calder, Mount (Prince of Wales Island)	do	3,371
Campbell Mountains	do	5,500
Cane Mountain	do	6,100
Carlisle Island (Islands of Four Mountains)	do	7,500
Carter, Mount	U. S. Geological Survey	4,700
Cascade	U. S. Coast and Geodetic Survey.	3,900
Case, Mount	do	5,510
Chapeau Mountain	do	2,000
Chenango Mountain (Annette Island)	do	2,987
Chichagof Peak	do	2,600
Chilkat Pass	do	3,100
Chilkoot Pass	do	3,500
Chipp Peak	do	2,532
Chisana Mountain	U. S. Geological Survey	3,200
Chowiet Island	U. S. Coast and Geodetic Survey.	1,200
Chugatch Mountains	U. S. Geological Survey	5,000 to 6,000
Chugul Island	U. S. Coast and Geodetic Survey.	4,300
Clara, Mount	do	6,000
Cleveland, Mount (Islands of Four Mountains)	do	8,156
Coghlan Island	do	436
Cone Mountain	do	2,718
Cook, Mount	do	13,758
Copper Mountain Range	U. S. Geological Survey	4,000 to 6,000
Cosmos Range	U. S. Coast and Geodetic Survey.	3,279
Cove Hill	do	619
Cranberry Peak	U. S. Geological Survey	5,200
Crater Lake (Chilkoot Pass)	U. S. Coast and Geodetic Survey.	3,500
Crater Mountain	do	633
Crillon, Mount	do	15,900
Cross Mountain	do	2,597
D'Agelet, Mount	do	9,708
Dahlgren Peak	do	3,502
Dana Peak	do	4,260
Davison Mountain (Annette Island)	do	2,652
DeLong Peak	do	3,737
Devils Thumb	do	9,062
Dome Mountain	do	2,100
Dome Peak	do	6,500
Drum, Mount	do	13,300
Dry Island	do	2,460
Duke Hill (Duke Island)	do	540
Du Relle, Mount	U. S. Geological Survey	4,300
Dyke Mountain	do	6,700
Eads Peak	U. S. Coast and Geodetic Survey.	4,636
Eagle Crag	do	5,705

Locality.	Authority.	Elevation.
		Feet.
East Peak	U. S. Geological Survey	4,900
Edgecumbe, Mount	U. S. Coast and Geodetic Survey.	2,800
Elbow Mountain	do	4,111
Emmerich, Mount	do	6,940
Entry Peak (Prince of Wales Island)	do	1,400
Ericson Peak	do	4,296
Etolin, Mount	do	3,778
Evans, Mount	U. S. Geological Survey	5,400
Everett Peak	U. S. Coast and Geodetic Survey.	3,645
Fairweather, Mount	do	15,292
Fanshaw, Mount	do	2,818
Fawn Mountain	do	2,112
Fighting John Peak	do	5,078
Figure Four Mountain	U. S. Geological Survey	2,200
Fillmore Peak	U. S. Coast and Geodetic Survey.	3,633
Flag Hill	U. S. Geological Survey	1,200
Flat Mountain	U. S. Coast and Geodetic Survey.	1,800
Fortymile Dome	U. S. Geological Survey	3,900
Fox Hill	U. S. Coast and Geodetic Survey.	563
Francis, Mount	U. S. Geological Survey	4,800
Franklin Peaks	U. S. Coast and Geodetic Survey.	4,314
Do	do	3,909
Fulton Peak	do	3,252
Gable Mountain	do	4,490
Gap Mountain	do	3,400
Gareloi Island	do	5,334
Garrett Peak	U. S. Geological Survey	5,700
Glacier Mountain	U. S. Coast and Geodetic Survey.	4,769
Glacier Mountain	U. S. Geological Survey	6,000
Golden Horn	U. S. Coast and Geodetic Survey.	6,400
Grant Peak	do	5,291
Gray Peak	do	4,694
Great Sitkin Island	do	5,033
Haeckel Hill	do	3,900
Hall Peak	do	3,726
Hamilton, Mount	U. S. Geological Survey	2,000
Hancock Peak	U. S. Coast and Geodetic Survey.	3,851
Harbor Peak	do	2,200
Harold, Mount	do	3,430
Harrison, Mount	do	6,955
Harry Saddle	do	2,088
Hawthorne Peak	do	4,021
Hayes, Mount	U. S. Geological Survey	14,500
Helmick Mountain	do	2,000
Herbert Island (Islands of Four Mountains).	U. S. Coast and Geodetic Survey.	5,291
Hog Back	do	300
Horn Mountain	do	2,929
Howard, Mount (Kuiu Island)	do	2,340
Hump Knoll	do	3,116
Hunt Peak	do	3,494
Iliamna Peak	do	12,066
Insignificant Ridge (Annette Island)	do	2,987
Irving Peak	do	2,169

Locality.	Authority.	Elevation. Feet.
Iskoot Mountain	U. S. Coast and Geodetic Survey.	4,799
Jade Mountains	do	3,500
Jamestown Peak	do	2,940
Janesville Mountain (Annette Island)	do	2,620
Jenkins Peak	do	3,292
Jubilee Mountain	do	6,380
Judy Hill	do	631
Kane Peak	do	3,292
Kasatocki Island	do	1,018
Kateekhuk Island	do	1,200
Kate, Mount	U. S. Geological Survey	4,600
Kates Needle	U. S. Coast and Geodetic Survey.	9,954
Katété Mountain	do	4,170
Keelikhtagikh Island (Semidi Islands)	do	750
Kimball, Mount	U. S. Geological Survey	10,000
Knob	U. S. Coast and Geodetic Survey.	4,250
Koniuji Island (Aleutian Islands)	do	1,113
Korovin Volcano (Atka Island)	do	4,852
Kusilvak Mountain	do	2,449
Kyska Island	do	3,700
Landslide	do	4,798
Lansdowne, Mount	do	6,140
La Perouse, Mount	do	10,740
Laura, Mount	do	7,527
Lazaro, Mount (Duke Island)	do	1,767
Leadville Mountain	do	1,797
Lincoln Peak	do	4,894
Little Sitkin Island (Aleutian Islands)	do	3,585
Lituya Mountain	do	11,832
Lockwood Peak	do	3,510
Logan, Mount	do	9,000
Longfellow Peak	do	2,955
Lorne, Mount	do	6,400
McDonough, Peak	do	2,873
McGrath, Mount	do	6,179
McKinley, Mount	U. S. Geological Survey	20,464
McMillan Mountains	U. S. Coast and Geodetic Survey.	3,500
Madison Peak	do	2,507
Makushin Mountain	do	5,474
Marr, Mount	U. S. Coast and Geodetic Survey.	2,447
Marshall Mountain	U. S. Geological Survey	5,200
Marshall Peak	U. S. Coast and Geodetic Survey.	3,017
Maury Peak	do	5,566
Mayer Peak	U. S. Geological Survey	6,100
Meiklejohn Pass	do	4,500
Mentasta Pass	do	2,300
Michie Mountain	U. S. Coast and Geodetic Survey.	5,540
Miners Range	do	4,000 to 4,500
Missionary Ridge	do	2,450 2,650 2,715 2,851
Moosehorn Mountain	U. S. Geological Survey	5,000

Locality.	Authority.	Elevation.
		Feet.
Moss Mountain	U. S. Coast and Geodetic Survey.	1,631
Mound Hill	do	1,956
Muckacharne	do	1,600
Mud Glacier	do	5,426
Nakat Mountain	do	2,921
Navy Peak	do	3,734
Nichols Hills	do	250
North Quadra Mountain	do	2,353
Notch Mountain	do	1,879
Oratia Mount	U. S. Geological Survey	6,000
Ourand Mount	do	4,300
Parsons Peak	U. S. Coast and Geodetic Survey.	5,500
Patterson Peak	do	4,746
Pelly Mountains	do	5,000 to 7,000
Pinnacle	do	8,346
Pogrumnoi Volcano (Unimak Island)	do	5,523
Porter Peak	do	4,798
Portland Island	do	206
Powell Knob	do	2,655
Purple Mountain (Annette Island)	do	2,447
Putnam Peak	do	3,887
Pyramid Peak	do	4,068
Quay Peak (Chugatch Mountains)	U. S. Geological Survey	5,000
Red Bay Mountain	U. S. Coast and Geodetic Survey.	2,843
Red Mountain	do	2,404
Reverdy Mountains	do	5,485
Rich Mountain	U. S. Geological Survey	5,000
Ripinski, Mount	U. S. Coast and Geodetic Survey.	4,060
Romig, Mount	U. S. Geological Survey	2,500
Rootck Island	U. S. Coast and Geodetic Survey.	3,888
Roundabout Mountain	U. S. Geological Survey	1,000
Round Hill	U. S. Coast and Geodetic Survey.	1,647
St. Elias, Mount	do	18,024
St. Michaels Mountain	do	472
St. Paul (one of Pribilof Islands)	do	633
Sajaca (Tanaga Island)	do	7,103
Sanford, Mount	U. S. Geological Survey	14,000
Sannak Peak (Sannak Island)	U. S. Coast and Geodetic Survey.	1,850
Saranac Peak	do	2,683
Seattle, Mount	do	10,000
Seguam Island	do	2,098
Semichi Islands	do	818
Seminow Hills	do	3,500 to 4,000
Sentinel Peak	do	4,250
Seward Mountains	do	[1] 4,000
Sharp Peak	U. S. Geological Survey	5,900
Shed Mountain	U. S. Coast and Geodetic Survey.	2,620
Shell Hills	U. S. Geological Survey	1,500 to 1,700

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[1] Approximate.

Locality.	Authority.	Elevation.
		Feet.
Shishaldin Volcano (Unimak Island)	U. S. Coast and Geodetic Survey.	8,952
Simpson, Mount	U. S. Geological Survey	5,200
Simpson Mountains	U. S. Coast and Geodetic Survey.	6,500
Snow Cap	do	5,078
Snow Tower	do	7,100
Snowy Mountain	do	5,577
South Island (Semidi Islands)	do	250
South Quadra Mountain	do	1,764
Spirit Mountain	U. S. Geological Survey	3,000
Split Top Mountain	do	2,100
Spuhn Island	do	246
Stephens Mountain	do	331
Stripe Mountain	do	2,300
Stuart Mountain (Stuart Island)	do	483
Sugar Loaf Mountain	do	5,259
Sukhlikh Island (Semidi Islands)	do	200
Summit Glaciers	do	5,700
Summit Peaks	U. S. Geological Survey	5,800
Sunny Mountain	do	4,400
Sunset Island	U. S. Coast and Geodetic Survey.	404
Survey Mountains	do	2,916
Sushitna, Mount	do	5,500
Taku Mountain	do	2,170
Tamgas Mountain (Annette Island)	do	3,684
Tanaga Island	do	6,975
Tangent Peak	do	2,449
Tent Mountain	do	7,100
Terrace Mountain	U. S. Geological Survey	6,000
The Nipples	U. S. Coast and Geodetic Survey.	2,900
The Sisters	do	1,021 1,325 1,308 1,369 1,555 1,680 1,593 1,589 1,350
Thomas, Mount	U. S. Geological Survey	5,400
Thunder Mountain	U. S. Coast and Geodetic Survey.	3,080
Tigalda Island	do	1,207
Tillman, Mount	U. S. Geological Survey	13,300
Tohtankella Mountain	U. S. Coast and Geodetic Survey.	3,000
Trout Hill	do	893
Tsesiuh Mountains	do	3,500
Turner, Mount	do	5,953
Twin Peaks	do	6,638
Vancouver, Mount	do	15,666
Verstovaia, Mount	do	3,216
Villard, Mount	do	5,100
Vsevidof Volcano (Umnak Island)	do	8,000
Wagner, Lake	U. S. Geological Survey	1,900
Warm Spring Mountain	U. S. Coast and Geodetic Survey.	3,370
Washington Peak	do	3,557
Waterfall Peak	do	3,403
Webster Peak	do	3,254

Locality.	Authority.	Elevation.
		Feet.
West Peak	U. S. Geological Survey	5,600
Whipple, Mount	U. S. Coast and Geodetic Survey.	6,033
White Pass	do	2,886
Wilkes Peak	do	3,156
Willoughby Island	do	1,545
Wrangell Peak	do	3,800
Wrangell, Mount	do	17,500
Wright, Mount	do	4,944
Do	do	6,300
Yellow Hill (Annette Island)	do	554
Yenlo Mountain	U. S. Geological Survey	4,000
Young, Mount	U. S. Coast and Geodetic Survey.	5,260
Yukon Hills	do	1,000 to 2,500
Yunaska Island	do	2,864

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DEPARTMENT OF THE INTERIOR

BULLETIN

OF THE

UNITED STATES

GEOLOGICAL SURVEY

No. 170

WASHINGTON
GOVERNMENT PRINTING OFFICE
1900

May 12, 1903
Mineralogical Laboratory
from
U. S. Geological Survey

UNITED STATES GEOLOGICAL SURVEY

CHARLES D. WALCOTT, DIRECTOR

SURVEY

OF THE

BOUNDARY LINE BETWEEN IDAHO AND MONTANA

FROM

THE INTERNATIONAL BOUNDARY TO THE CREST OF THE BITTERROOT MOUNTAINS

BY

RICHARD URQUHART GOODE

WASHINGTON
GOVERNMENT PRINTING OFFICE
1900

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LETTER OF TRANSMITTAL.

DEPARTMENT OF THE INTERIOR,
UNITED STATES GEOLOGICAL SURVEY,
Washington, D. C., February 21, 1900.

SIR: I have the honor to transmit herewith a detailed report relating to the survey of the boundary line between Idaho and Montana from the international boundary to the crest of the Bitterroot Mountains.

I wish to make acknowledgment of the valuable services rendered in this connection by Messrs. S. S. Gannett and D. L. Reaburn, in field and office, and by Mr. E. T. Perkins, jr., in the field. Mr. Gannett prepared the greater portion of the material relating to latitude, longitude, base line, azimuth, and triangulation.

Very respectfully,

RICHARD U. GOODE,
Geographer.

Hon. CHARLES D. WALCOTT,
Director United States Geological Survey.

SURVEY OF THE BOUNDARY LINE BETWEEN IDAHO AND MONTANA FROM THE INTERNATIONAL BOUNDARY TO THE CREST OF THE BITTERROOT MOUNTAINS.

By **Richard U. Goode.**

INSTRUCTIONS.

The survey of the boundary line between Idaho and Montana was provided for by the Fifty-fourth Congress in the sundry civil act approved June 4, 1897.

The following correspondence is self-explanatory:

Department of the Interior,
United States Geological Survey,
Washington, D. C., June 5, 1897.

The honorable the Secretary of the Interior.

Sir: In response to your verbal request, I have the honor to transmit herewith suggested instructions relating to the survey of the boundary line between Idaho and Montana.

I am, with respect, your obedient servant,

Chas. D. Walcott, *Director.*

INSTRUCTIONS RELATING TO THE SURVEY OF THE BOUNDARY LINE BETWEEN IDAHO AND MONTANA.

Included in the act making appropriations for sundry civil expenses of the Government for the fiscal year ending June 30, 1898, and for other purposes, is found the following law:

> For surveying that portion of the boundary line between Idaho and Montana beginning at the intersection of the thirty-ninth meridian with a boundary line between the United States and the British possessions, including the retracing of so much of the international boundary line as may be found necessary for the determination of said intersection, then following said meridian south until it reaches the summit of the Bitterroot Mountains, and for locating points on said meridian by triangulation from the Spokane base of the United States Geological Survey, and on the continuation of said boundary line along the Bitterroot Mountains between Idaho and Montana, seven thousand six hundred and fifty dollars, or so much thereof as may be necessary, to be immediately available: *Provided*, That the Secretary of the Interior shall direct that the survey shall be executed under the supervision of the Director of the Geological Survey by such persons as may be employed by or under him for that purpose, and such survey shall be executed under instructions to be issued by the Secretary of the Interior: *Provided further*, That the plats and field notes thereof prepared shall be approved and

certified to by the Director of the Geological Survey, and three copies thereof shall be returned, one for filing in the surveyor-general's office of Idaho, one in the surveyor-general's office of Montana, and the original in the General Land Office.

In carrying out the provisions of the law above quoted three special processes are involved:

First. The accurate location of the thirty-ninth meridian on the ground by triangulation from the Spokane base of the United States Geological Survey, including the retracing of so much of the international boundary line as may be found necessary for the determination of the intersection of the thirty-ninth meridian with the said boundary line, as well as for locating points on the continuation of the boundary between Montana and Idaho along the summit of the Bitterroot Mountains.

Second. The marking on the surface of the ground, by proper monuments, of the boundary as determined.

Third. The preparation of the necessary plats and field notes.

With reference to the above, the following instructions will be observed:

LOCATING THE BOUNDARY.

The Spokane base of the United States Geological Survey is referred to the meridian of Greenwich, and the thirty-ninth meridian above mentioned has for its initial point the meridian of the old Naval Observatory at Washington. By applying the proper correction and referring the thirty-ninth meridian west of Washington to the meridian of Greenwich, the result is that the meridian to be determined as the boundary line between Idaho and Montana is 116° 03′ 02″.30 west of Greenwich.

The triangulation from the Spokane base will be extended eastward so as to accurately locate the intersection of the meridian above mentioned west from Greenwich with the summit of the Bitterroot Mountains. It may be that this identical point can not be located directly by triangulation, but a point as near thereto as may be possible should be so located, and from this the exact point should be determined by careful traverse based on an astronomic or calculated azimuth and distances determined by direct chaining or stadia measurement, whichever may be most practicable.

After the point referred to, namely, the intersection of the meridian 116° 03′ 02″.30 west from Greenwich with the summit of the Bitterroot Mountains, has been determined, the triangulation is to be extended northward, locating as many points as may be practicable as near as may be to the boundary line between Idaho and Montana until the international boundary is reached. From the points so located by triangulation other points exactly on the boundary will be determined by traverse in the manner hitherto mentioned. The international boundary line is supposedly on the forty-ninth parallel of latitude. It will not, however, answer the purpose to rely on the location of this parallel from the Spokane base, but it must be determined with reference to an existing monument or monuments, being carefully retraced until its point of intersection with the meridian is exactly located.

The distance along the international boundary from the nearest monument, or the monument recovered, to the point of intersection will be determined either by triangulation or direct measurement with chain or stadia or a combination of the two methods.

After points as above described have been located on the boundary line between Idaho and Montana from the international boundary to the summit of the Bitterroot Mountains, these points will be joined by true meridian lines, so that a sufficient number of points on the boundary in addition may be determined to fulfill the conditions made necessary under the provisions hereinafter mentioned for marking the line. Upon the completion of the survey and marking of the portion of the boundary line coincident with the thirty-ninth meridian, the triangulation will be extended in a southeasterly direction so as to locate points on the continuation of the said boundary line along the Bitterroot Mountains.

All triangulation will be executed in accordance with instructions issued by the Director of the United States Geological Survey under date of February 15, 1897.

In running lines between points located on the boundary the following instructions will be observed:

The instrument used must be a first-class transit instrument, reading to minutes or less, with or without solar attachment, but provided with stadia wires, and must be kept constantly in adjustment. In running the line, double back and fore sights with telescope direct and reversed must be taken, in order to guard against errors resulting from imperfect adjustment of the line of collimation. It is absolutely necessary to follow this method whenever meridian lines are run, in order to avoid errors in the course.

When offset lines are necessary, the notes must fully explain the procedure, and a diagram of such offsets must be inserted after the verbal description.

Observations on Polaris for azimuth must be taken on the line every night, weather and other circumstances permitting, and the record of such observations must be given in detail in the notes in the manner as described in the Manual of Surveying Instructions for the Survey of the Public Lands of the United States, issued by the Commissioner of the General Land Office under date of June 30, 1894.

Temporary marks will be established on the preliminary or random lines between located points, and on reaching a closing point the departure therefrom will be noted. The true line will then be established, and permanent marks placed by shifting the positions of the temporary marks with a swing proportionate to the closure error and distances. Distances along the line will be carried by stadia or chaining, so that it will be possible to locate accurately all monuments established, as well as all topographic and cultural features. The distances thus obtained will be checked in closing from one located point to another.

A full description of all monuments, the character of the timber and soil, the distances to the crossing of all bridges, rivers, lakes, outlines of wooded areas, railroads, roads, trails, and other prominent features will be fully recorded in the field notes, and a sketch of the topographic features adjacent to the boundary line will be made, as well as from each triangulation station on or near the line and from any traverse that may be run in connection with the line. Intersections will be made whenever possible on all important objects susceptible of location.

The magnetic declination will be determined in connection with each transit observation on the line.

MARKING THE LINE.

Monolithic monuments will be placed on the boundary at the following places: Near the Northern Pacific Railway, near the Great Northern Railway, and near the north bank of the Kootenai River. These monuments are to be 6 feet long and 10 inches square, minimum dimensions, and are to be placed in a truly vertical position, set 3 feet in the ground and with their faces directed to the cardinal points. They are to be of undressed stone, except for a space sufficient to cut the words "Idaho" and "Montana" on the west and east sides, respectively, which will be dressed smooth, and the letters shall be 2 inches high, of proportionate width and of the style known as Egyptian. The same kind of monuments will be placed on the line at the international boundary and at the summit of the Bitterroot Mountains if it shall be found practicable to transport them in one mass, otherwise they will be prepared in the quarry in every respect similar to those mentioned above and will then be sawed into sections of such size as to be readily transported on pack mules to their destinations. They will then be firmly and securely cemeted with Portland cement and established in the same manner as the other stone monuments. The monument on the international boundary in addition to having the inscription "Idaho" and "Montana" on the west and east sides, respectively, will have "Canada" inscribed on the north.

Intermediate between the stone monuments above described will be placed at prominent summits, road, trail, or stream crossings, at distances not exceeding a mile apart, and intervisible whenever possible, wrought-iron posts 6 feet in length, 3 feet of which shall be above ground and 3 feet below the surface, with a brass cap similar in general design to the standard iron posts used by the United States Geological Survey. The cap surmounting the post will be inscribed as below, the line cut on the cap being coincident with the boundary line:

IDAHO
BOUNDARY

LINE
MONTANA

Under each post will be placed a stone marked with charcoal or a vial filled with ashes.

It is assumed that generally a soil surface for the insertion of the stone or iron posts can be found sufficiently near the points it is desired to establish the monuments. If, however, the exact point should fall on rock at the international boundary or the summit of the Bitterroot Mountains, a hole will be chiseled in the rock to a depth of about 8 inches and a little larger than the base of the monument. Into this hole the monument will be firmly cemented with the best Portland cement. If the point for the location of one of the iron posts should fall on a rock surface, a copper plug similar to that used by the United States Geological Survey will be cemented in the rock and a truncated conical mound of stone, not less than 2½ feet high and 5 feet broad, will be placed to the north of the point at a distance of 4 feet from it. The copper plug will be stamped as follows: $\frac{\text{MONT.}}{\text{IDA.}}$ and will be properly oriented.

When suitable bearing trees are found within a distance of 100 feet of a stone monument or iron post, they must be marked on the side facing the corner in the manner prescribed in the manual for special corners.

In addition, each iron post will be witnessed, when possible, by mounds of earth or stone, one in Idaho and one in Montana, the material for the mounds to be taken from pits, one north and one south of the post, dug crosswise of the line. The pits will be 3 feet east and west, 2 feet north and south, and 1 foot deep, and their centers, as well as the centers of the mounds, will be 4 feet from the center of the iron post.

PLATS AND FIELD NOTES.

Special attention is called to the provisions of the law relating to plats and field notes.

All plats and field notes shall be approved and certified to by the Director of the Geological Survey, and four copies thereof shall be returned—one for filing in the surveyor-general's office of Idaho, one in the surveyor-general's office of Montana, one in the office of the Geological Survey, and the original in the General Land Office. All field notes must be transcribed on a typewriting machine.

The results of the topographic notes will be embodied in a map which will be drawn on a scale of 1 inch to a mile. Detailed diagrams of the points on the international boundary and at the intersections of the Bitterroot Mountains will be made.

All parties engaged in the prosecution of this survey will be sworn before an officer duly qualified to administer oaths at the beginning and end of the survey. The oath of the chief of party must be taken either before the clerk of the district court or a United States commissioner. (See Manual, page 64.)

DEPARTMENT OF THE INTERIOR,
Washington, June 5, 1897.

The DIRECTOR OF THE GEOLOGICAL SURVEY.

SIR: Your letter of the 5th instant has been received, submitting for my consideration and approval instructions relating to the survey of the boundary line between Idaho and Montana, for which provision was made in the sundry civil appropriation bill, approved June 4.

The instructions in question have been approved by indorsement thereon and are herewith returned.

Very respectfully,
C. N. BLISS, *Secretary.*

DEPARTMENT OF THE INTERIOR,
UNITED STATES GEOLOGICAL SURVEY,
Washington, D. C., June 7, 1897.

Mr. R. U. GOODE, *Geographer.*

SIR: The execution of the necessary work in connection with the survey of the boundary line between Idaho and Montana, as provided for in the sundry civil bill for the fiscal year 1897–98, is placed under your supervision.

This work will be performed in accordance with instructions approved June 5, 1897, by the Secretary of the Interior.

The sum of $7,650 has been appropriated in this connection, and you are authorized, within the limits of the above appropriation, to employ such temporary field assistants as may be necessary for the proper prosecution of the survey, and to make such journeys and to order your assistants to make such journeys as may be necessary in carrying forward the work.

Very respectfully,
CHAS. D. WALCOTT, *Director.*

BOUNDARY LINES.

Territorial and State lines in the northwestern portion of the United States have undergone many changes. Originally this area was included partly in Louisiana and partly in Oregon, the dividing line being the crest of the Rocky Mountains.

Oregon Territory was organized August 14, 1848. Its area at that time included the present States of Oregon, Washington, and Idaho, and portions of Wyoming and Montana. The Territory of Nebraska, formed from a portion of the Louisiana Purchase, was organized May 30, 1854. Its original area extended from Minnesota on the east to the continental watershed on the west, and included the existing State of Nebraska and portions of Colorado, Wyoming, Montana, North Dakota, and South Dakota. The Territory of Dakota was formed March 2, 1861, from parts of the State of Minnesota and the Territory of Nebraska, and on March 3, 1863, the Territory of Idaho was formed of portions of Nebraska, Dakota, and Washington, the latter having been organized March 2, 1853, from a portion of the Territory of Oregon. Originally, Idaho contained about 324,875 square miles, but in 1864 it was reduced 146,080 square miles by the formation of the Territory of Montana, which was taken entirely from Idaho, and in 1868 it was further reduced by the formation of the Territory of Wyoming, almost the whole of which (93,995 square miles) was taken from Idaho. Montana to-day stands as originally organized, while Idaho contains about 84,800 square miles.

The present boundaries of Montana are described as follows:

> Beginning at the intersection of the twenty-seventh meridian of longitude with the boundary line between the United States and the British possessions, it follows said meridian south to the forty-fifth parallel of latitude; thence west on this parallel to the thirty-fourth meridian; south on the thirty-fourth meridian to the point where that meridian intersects the continental watershed; thence westward and northwestward, following the line of the continental watershed and the summit of the Bitterroot Range to its intersection with the thirty-ninth meridian; thence north on the thirty-ninth meridian to the boundary line between the United States and British possessions, and east on that boundary line to the point of beginning.

The present boundaries of Idaho are described as follows:

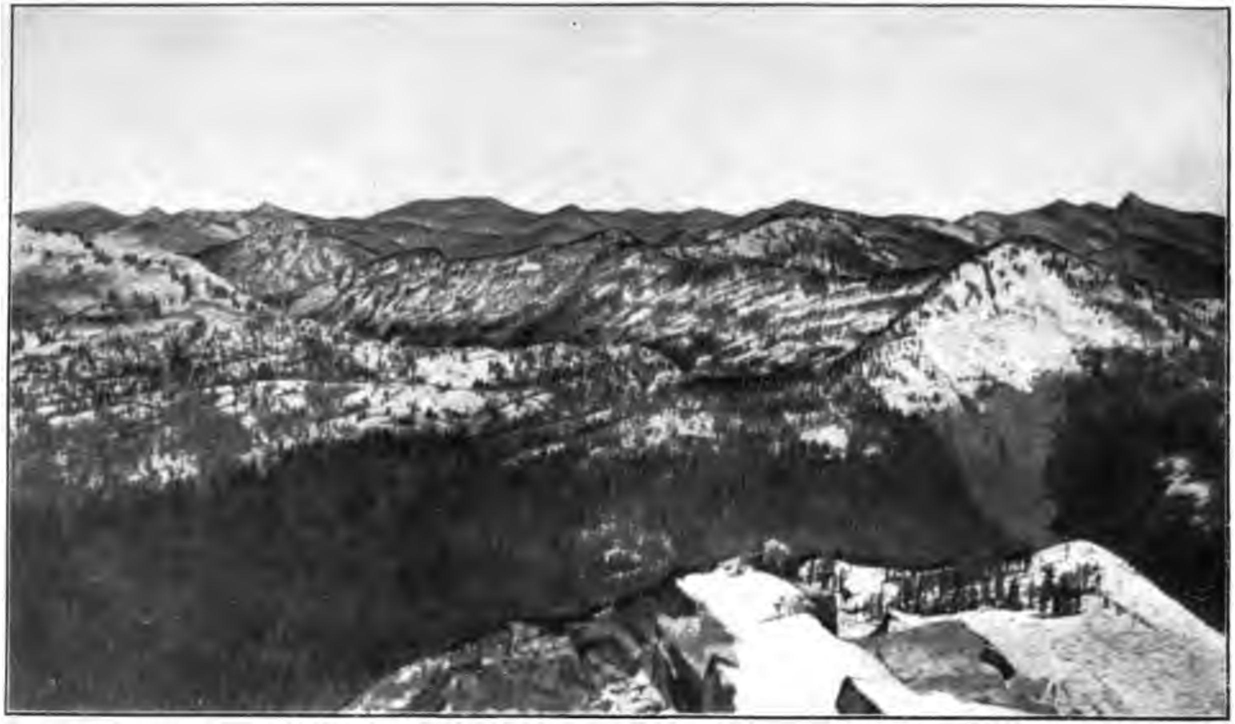
> Beginning at the intersection of the thirty-ninth meridian with the boundary line between the United States and the British possessions, it follows said meridian south until it reaches the summit of the Bitterroot Mountains; thence southeastward along the crest of the Bitterroot Range and the Continental Divide until it intersects the meridian of thirty-four degrees of longitude; thence southward on this meridian to the forty-second parallel of latitude; thence west on this parallel of latitude to its intersection with a meridian drawn through the mouth of the Owyhee River; north on this meridian to the mouth of the Owyhee River; thence down the midchannel of the Snake River to the mouth of the Clearwater; and thence north on the meridian which passes through the mouth of the Clearwater to the boundary line between the United States and the British possessions, and east on said boundary line to the place of beginning.

The boundary under discussion is the common one mentioned above.

In the United States State boundary lines may be grouped in two general classes:

First. Those that are defined by some natural physical feature, such as an ocean or a lake shore, the channel or bank of a stream, the summit of a range of mountains, or a watershed.

Second. Those that are defined by imaginary lines which must be traced on the earth's surface by astronomic or mathematical processes. Such a line may be a meridian of longitude, a parallel of latitude, a line between two points (such as a portion of the eastern boundary of Nevada, which is from the intersection of the one hundred and twentieth meridian and the thirty-ninth degree of latitude to a point on the Colorado River where it intersects the thirty-fifth degree of latitude), a line defined by azimuth and distance or a number of such lines consecutively joined (such as the boundary line between Maine and New Hampshire), a line determined by a given direction from a certain point terminating at its intersection with some other line



CREST OF BITTERROOT MOUNTAINS.

(such as a portion of the western boundary of Idaho, which runs from a point in the channel of Snake River opposite the mouth of the Clearwater due north to the thirty-ninth parallel of latitude), or a tangent or arc of a circle (such as the western and northern boundary of Delaware).

Generally speaking, boundary lines of the first class need no monuments to indicate their location, while those of the second class must be perpetuated by marks of some kind after their positions have been determined.

The boundary line between Idaho and Montana is made up of two sections, falling into the two classes mentioned. The first section is that part defined as the thirty-ninth meridian, between the international boundary and the summit of the Bitterroot Mountains; and the second section is the sinuous line corresponding to portions of the crest of the Bitterroot and Rocky mountains, this line beginning at the intersection of one meridian line and terminating at another meridian line. The first section has been located and marked by monuments, as will appear hereafter. The second section is considered to be adequately determined, since it follows a watershed, and its terminal points have been marked—the northern one by the results of the survey under discussion, and the second by the results of the survey of the western boundary of Wyoming, which line follows the thirty-fourth meridian from the forty-first parallel to the crest of the Rocky Mountains. The survey of the latter line was authorized by an act of Congress approved March 3, 1873, and was made, under contract, by Alonzo V. Richards, astronomer and surveyor, in June, July, August, and September, 1874. The following is a description of the corner of Idaho and Montana on this line, as taken from the report of the survey above referred to:

> At 245 miles 56 chains and 50 links the corner of Idaho and Montana was established on the crest of the Rocky Mountains. It is commemorated by a pine post 11 feet long by 15 inches in diameter, 3½ feet in the ground, marked on north face "34° W. L., 1874;" on south face, "246 m. 56 chs. 50 lks.;" on east face, "Wyoming;" on southwest face, "Idaho;" on northwest face, "Montana;" and is squared 2 feet at the upper end in the shape of a pentagon. The point is further perpetuated by a stone in the bottom of the pit in which this post was set, marked "A. V. R," with several charred blocks. A conical mound of earth and stone was raised 4 feet high by 7 feet in diameter, with a pit in the corner of each of the three Territories 3 feet square by 2 feet deep. Then, on the top of the mound, on the east side, was placed a flat sandstone, marked "Wyoming;" another on the southwest side, marked "Idaho," and one on the northwest side, marked "Montana." Nineteen pine trees are noted as witnesses to this post.

It will be noted that the law provides for locating points on the continuation of the boundary line along the Bitterroot Mountains between Idaho and Montana. It was not possible to extend the triangulation beyond the southern extremity of the meridional portion of the boundary line, on account of the available funds not being sufficient for the purpose. In fact, the appropriation made would not have been adequate for the work that was accomplished if it had not been possible to utilize, in connection with the boundary line, work done under other appropriations. In this manner about 50 miles of the boundary were accurately located in connection with the survey of the Hamilton quadrangle, a portion of which is embraced within the limits of the Bitterroot Forest Reserve.

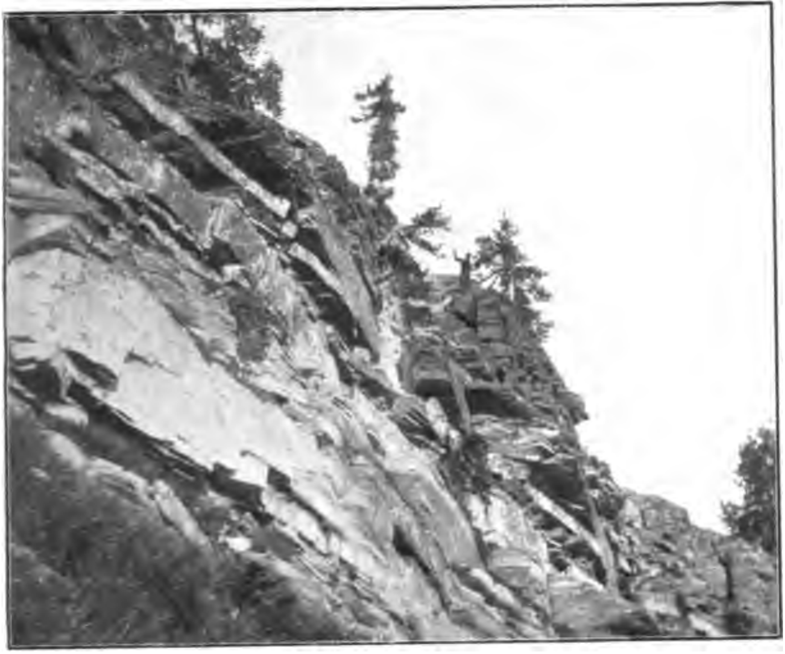
The crest line of the Rocky and Bitterroot mountains between Idaho and Montana is generally a clearly defined summit or watershed, so that no serious question need arise as to its identification as an inter-State boundary. (See Pl. I.) In a few localities, notably in some of the passes, there are morasses of small extent out of which the water flows or seeps in both directions. If the question of placing monuments to mark this line ever arose, the location of monuments in such swampy localities as are found to exist would probably fulfill all necessary requirements. It is, however, very desirable that topographic maps of the adjacent territory be prepared. Such maps would clearly differentiate the true summits from the diverging spurs, and prevent any possible misconception as to the location of the line. After these maps had been prepared there would be no further question of surveying, but merely one of placing monuments, should this be considered necessary.

It frequently happens, as the result of greater or less relative erosion or uplifting, that spurs have an elevation higher than that of the main watershed, and this is remarkably the case in certain portions of the Bitterroot Mountains. In fact, in those portions where detailed examinations have been made all of the higher points of the range are uniformly from 6 to 8 miles east of the present divide, and it is probably true that this divide, in the course of geologic time, has retreated from an irregular line which passed through these high points. This, if true, is due partly to the fact that the waters of the Bitterroot River draining to the eastward have a greater relative rate of fall, and consequently greater erosive power, than had the waters flowing westward through the Clearwater, and thus the territory tributary to the former is gradually being captured by and added to that of the latter.

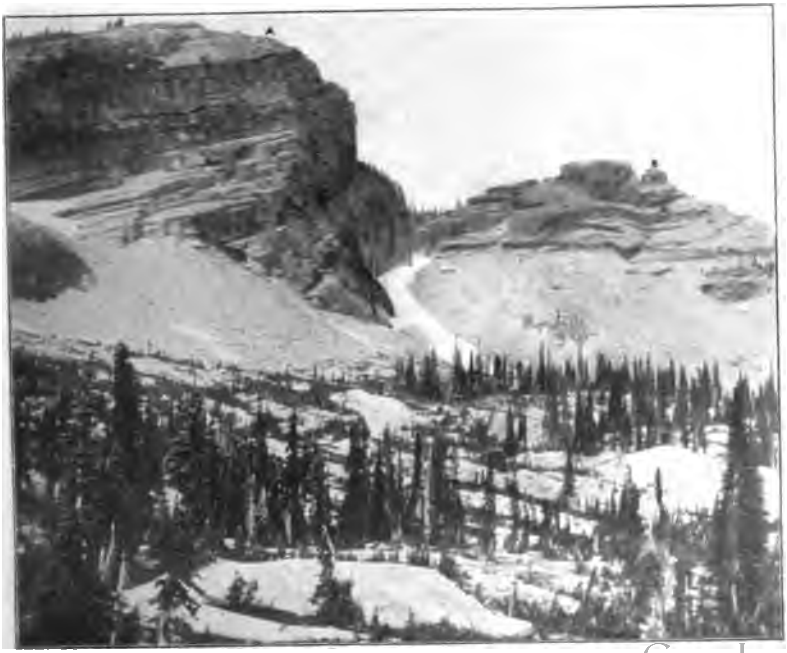
ACCOUNT OF OPERATIONS.

The work in connection with the boundary line extended through portions of three field and office seasons.

The act providing for the survey of the boundary line was approved June 4, 1897, and Mr. E. T. Perkins, jr., topographer, was immediately detailed for field work in connection with the triangulation. Mr. Perkins left the city of Washington on June 10, and proceeded to Spokane, Washington, by way of Boise, Idaho, stopping at the latter place to arrange for the transportation of certain property to



A. CABINET RANGE.



B. SUMMIT OF CABINET RANGE, SHOWING POINTS TOUCHED BY BOUNDARY LINE (A AND B).

be used in connection with the work. The party was organized at Spokane, and at first consisted of only a packer and a cook, but was afterwards increased by the addition of a field assistant, when angle observations were begun. When occasion required, for instance in clearing the timber for a triangulation station, extra men were hired by the day. Transportation was at first by saddle and pack animals alone, but later a light spring-wagon was added to the outfit.

The work was greatly retarded by smoke during the summer, which was at times so dense as to render observations impossible, and by unusually early storms in the fall. All operations were entirely suspended about October 1, the snow being so deep as to render practically impossible the ascent of the peaks used as triangulation stations. The season's work consisted in extending the triangulation from the Spokane base eastward, through a longitudinal interval of about 70 miles, to the boundary line. Fifteen stations were erected, nine of which were occupied, and one observation for azimuth was made. Another object accomplished during the field season was the identification on the ground of the Mooyie Trail monument, which had been established by the Northwestern Boundary Commission. This monument was about 8½ miles west of the boundary line between Idaho and Montana, and was the nearest monument or mark of any kind on or near the international boundary that could be identified. Further reference will be made to the Mooyie Trail monument.

After the party was disbanded, Mr. Perkins proceeded to California for duty. During the winter the office work pertaining to the triangulation was done under the direction of Mr. S. S. Gannett. Three figures were adjusted by least squares, and the geodetic positions of nine points were computed. One of the stations, Divide, was found to be 6,072 feet east of the Idaho-Montana boundary line, and another station, Scotchman, was found to be 7,842 feet west of it.

Field operations were resumed in June, 1898, two parties being organized, one for the extension and completion of the necessary triangulation, the other for running the random line northward from the point determined as the intersection of the thirty-ninth meridian west from Washington with the crest of the Bitterroot Mountains.

Mr. Perkins continued the triangulation, and the line party was organized by Mr. S. S. Gannett, topographer, with Mr. D. L. Reaburn, as transit man, the latter assuming charge of the party after the work was started.

Mr. Perkins extended his work of the preceding year northward to the international boundary, occupying nine new stations and reoccupying four old ones. A high signal was erected over the Mooyie Trail monument, and this point was located. Unfortunately the character of the country was such that it was impossible to get a location by triangulation near the northern terminus of the interstate boundary line.

Mr. Gannett was instructed to carefully examine the topographic features of the country adjacent to the triangulation station Divide, in order to determine whether it was on the true summit of the Bitterroot Mountains, and then, by traverse from the Divide station, to locate the exact point on the summit from which, as the initial point, the random line should be projected northward. Observations for azimuth were obtained at Divide, the details of which will appear hereafter, and also at the end of the traverse line. This traverse was run along the divide westward through a longitudinal interval which was supposed to be 6,072 feet, but, unfortunately, owing to an error in the field computations, the location of the initial point was made 177 feet too far east. This error was discovered in the office, and in the adjustment of the random line it was entirely eliminated from the final results.

Work on the random line was commenced July 11 by the party under Mr. Reaburn, which consisted of one recorder, two rodmen, two packers, three axmen, and a cook. The region traversed was along the entire line very rough and generally covered with timber. There were few roads or open trails, and the transportation problem was a difficult one. A pack train was provided, and it was generally necessary to make long detours and to cut out trails in order to establish camps at convenient points near the line. Toward the close of the season a great deal of snow was encountered on the high ridges, the party narrowly escaping being snowed in without provisions. The survey of the random line was completed to the vicinity of the international boundary on October 31 in snow 2½ feet deep.

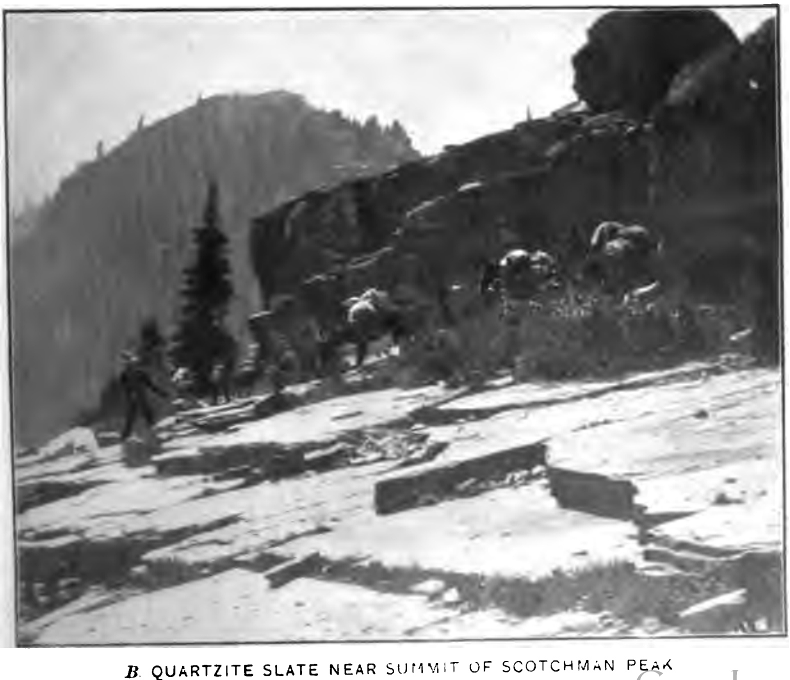
Horizontal and vertical distances along the entire line were obtained by stadia measurements. The total rise and fall of the boundary line was about 63,000 feet, the average length of sights 350 feet, length of line about 72 miles, number of transit stations 1,051, and number of azimuth stations 17.

At the conclusion of the field season Mr. Perkins returned to the office and Mr. Reaburn was ordered to field duties elsewhere.

During the office season of 1898–99, after the triangulation had been finally computed, an adjustment of the stadia work to the triangulation was made, and tables were prepared showing the exact latitudinal and longitudinal corrections to be applied at each station of the random line. Elevations were also computed from the vertical angles for each transit station. Six sheets on mounted drawing paper, each sheet extending through a latitudinal interval of 10′, were then prepared. On these sheets was drawn the boundary line in its true position, and all topographic features which had been located from the random line were indicated. Such elevations as would be useful in sketching contours were also placed on the sheets, and the sheets thus arranged were used for sketching the topography adjacent to the line.

Mr. Reaburn resumed field operations about the middle of June,

A. CAMP SOUTH OF SUMMIT OF CABINET RANGE.



B. QUARTZITE SLATE NEAR SUMMIT OF SCOTCHMAN PEAK

1899, the party as organized being similar to that of the preceding season. The field work which remained was to remeasure a portion of the line, place the monuments, cut out the true line, and secure additional data for the map.

The line was divided into four sections, reference to which will be made hereafter. Three of them were controlled by triangulation, but the fourth, or northernmost section, not being so controlled, it was decided to remeasure that section with the stadia, and also to make a careful comparative measurement with a steel tape. The measurement with the steel tape served not only to check this section of the line, but was also used as a basis of comparison with the stadia measurements and to determine a stadia factor, which was afterwards applied to all of the stadia work.

The measurements of the northernmost section were first made, and the northern terminal point of the line determined. The party then started southward, and the monuments were established, marked, and witnessed in accordance with the instructions. The topography was also sketched, but as the territory through which the line ran was for the most part covered with timber, it was impossible, without delaying the work beyond the limit of the available funds, to cover more than a narrow belt. This work was completed October 5, 1899, and after a short service in another locality Mr. Reaburn reported to the office in Washington for the preparation of the final notes and plats.

LATITUDE, LONGITUDE, BASE LINE, AZIMUTH, AND TRIANGULATION.

In the following pages is given a short account of the methods employed in establishing what may be termed "the control" for the boundary line.

By combining the results of the latitude, longitude, and azimuth observations with the base-line measurement, the position on the earth's surface and the length and true direction of a line were determined. Through a system of triangulation based on the line thus established the positions of points near the boundary line were computed, as well as the distances and directions between these points.

LATITUDE.

The new county court-house at Spokane having been built very close to the longitude pier of the United States Coast and Geodetic Survey of 1888, the latter could not be used as a latitude pier. A new pier was therefore built 67.4 feet east of the longitude pier, where an unobstructed view of the meridian could be obtained. (See Pl. IV.)

A Fauth combined transit and zenith telescope (No. 534) was mounted on this pier, and in August, 1896, observations for latitude, by the Talcott method, were made by Mr. S. S. Gannett. Pairs of stars were selected from Safford's Catalogue of 2018 Stars. The apparent day places, however, were obtained from the Berliner Jahrbuch whenever possible; otherwise, they were computed by the usual methods, as explained in the American Ephemeris.

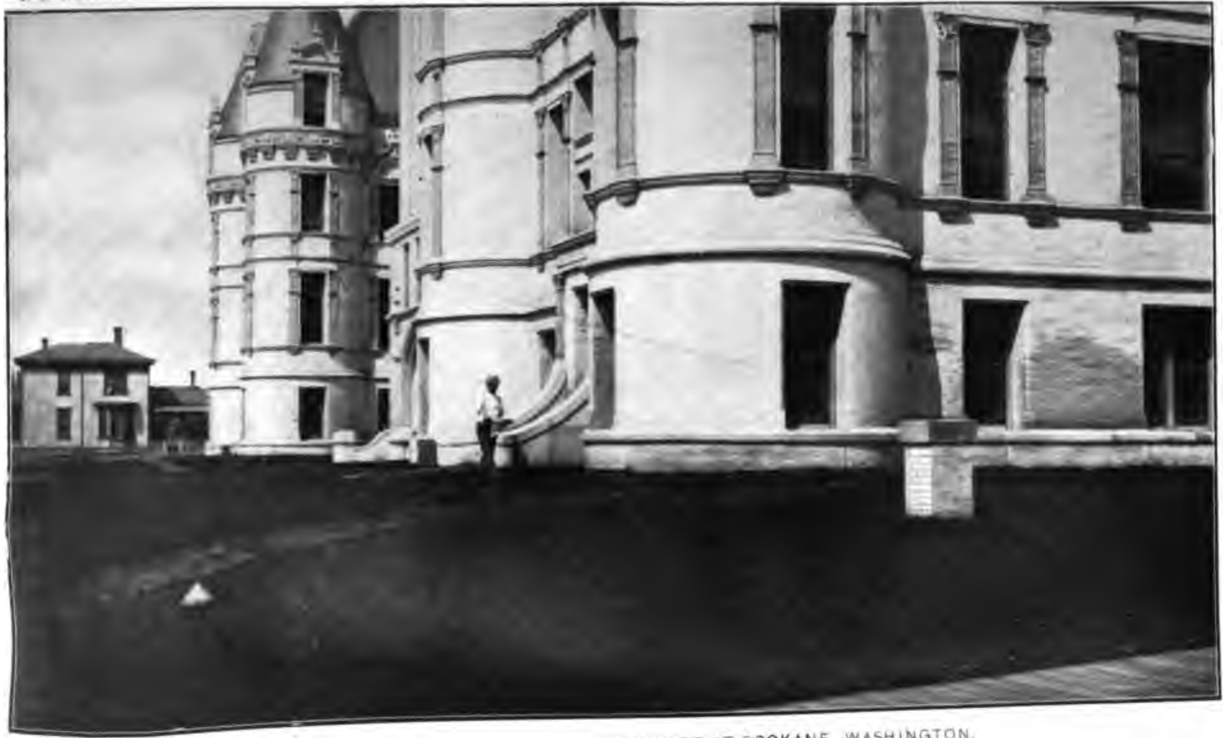
Fifty-nine observations upon twenty-seven pairs of stars gave a weighted mean value for the latitude of the pier of 47° 39′ 51″.46 ± 0″.13. The results for different nights and for different pairs of stars are given in the following table:

Results for latitude, Spokane (Washington) Station, 1896.

[S. S. Gannett, observer and computer.]

Stars (Safford), number and class.	Individual results. 47° 39′.				Mean.	Weight.
	Aug. 6.	Aug. 7.	Aug. 8.	Aug. 9.		
	Seconds.	*Seconds.*	*Seconds.*	*Seconds.*	*Seconds.*	
748 A, 759 A			51.54	50.17	50.85	1.72
766 A, 782 C		50.05		53.27	51.66	1.28
772 A, 782 C				51.46	51.46	0.79
795 C, 801 AA		51.69	50.70	50.66	51.02	1.69
809 C, 852 A		50.04	50.92	49.01	49.99	1.62
814 A, 852 A		50.16	49.68	49.80	49.88	2.40
814 A, 856 AA		50.90	49.57		50.24	1.80
809 C, 856 AA		50.78	50.80		50.79	1.32
809 C, 834 AA				49.81	49.81	0.80
814 A, 834 AA				50.58	50.58	0.96
882 AA, 917 C			52.08		52.08	0.80
901 C, 903 AA				51.05	51.05	0.80
903 AA, 920 C				50.65	50.65	0.80
931 B, 949 A		52.56		49.71	51.18	1.63
957 A, 969 A		52.15		51.30	51.67	1.72
987 A, 989 B	53.81	53.58	53.12	52.52	53.26	2.70
989 B, 1000 AA	52.46	52.90	52.38	51.74	52.37	2.90
1011 B, 1032 B				51.57	51.57	0.88
1016 B, 1032 B	52.10		51.57	52.66	52.11	2.05
1032 B, 1037 B	51.62	51.36	51.78	51.20	51.49	2.47
1032 B, 1047 C		51.58	52.02	50.15	51.25	1.53
1059 A, 1078 A	52.82	51.59	51.75	49.14	51.32	2.99
1188 AA, 1129 A		52.21	51.37	51.07	51.16	2.55
1129 A, 1146 B		53.54	53.37		53.45	1.63
1133 AA, 1158 A				52.63	52.63	0.96
1161 A, 1173 C			50.30		50.30	0.79
1202 AA, 1207 A		53.06	53.00		53.03	1.80

Weighted mean, 47° 39′ 51″.46 ± 0″.13.



ASTRONOMIC PIERS IN COURT-HOUSE GROUNDS AT SPOKANE, WASHINGTON.

U. S. Geological Survey latitude pier in right foreground; U. S. Coast and Geodetic Survey longitude pier behind figure of man.

LONGITUDE.

The meridional portion of the line is defined as corresponding to the thirty-ninth degree of longitude west from Washington.

Section 435, Revised Statutes, provides that "The meridian of the Observatory at Washington shall be adopted and used as the American meridian for all astronomical purposes," and this has been construed as meaning the old Naval Observatory. The latest adjustment by the United States Coast and Geodetic Survey fixes the longitude of the center of the dome of the United States Naval Observatory (old site) at $5^h\ 08^m\ 12^s.153 \pm 0^s.049$, or $77^\circ\ 03'\ 02''.30 \pm 0''.74$; hence the longitude of the meridian corresponding to the boundary line between Idaho and Montana is $116^\circ\ 03'\ 02''.30$.

The United States Coast and Geodetic Survey has published an adjusted network of telegraphic longitude determinations, including points distributed in various localities throughout the United States. This system includes the Naval Observatory at Washington and also a station at Helena, Montana. From Helena the Coast Survey in 1888 determined the longitude of a pier in the court-house grounds at Spokane.

The nightly programme at each station was to observe, with an astronomic transit, two sets of ten stars each for local time, each half set consisting of four stars having a mean azimuth factor nearly equal to zero, and one circumpolar star. Two such half sets, with a reversal of the telescope in the Y's between them, give a strong time determination. The same sets of stars were observed at Helena and at Spokane, thus giving the chronometer error for each local meridian.

Between the two time sets the chronometers were compared by telegraph, thus giving the difference in time, and consequently in longitude, between the meridians within a small fraction of a second. As will be noticed in the following table, such observations and chronometer comparisons were made on four nights, when the observers interchanged places and made similar observations and chronometer comparison on four other nights, thus eliminating the effect of "personal equation."

The figures relating to this description, which were kindly furnished by the Superintendent of the United States Coast and Geodetic Survey, are presented below:

Resulting difference of longitude between the astronomic stations at Spokane, Washington, and Helena, Montana, as determined by the United States Coast and Geodetic Survey in September, 1888.

Date.	Observer.		From western or Spokane signals.	From eastern or Helena signals.	W. E.	Mean of west and east signals.	Correction for personal equation.	Difference of longitude. Δ λ	Combination weight.	Difference. v
	Spokane.	Helena.								
1888.			′ ″	′ ″	°	′ ″	″	′ ″		″
Sept. 13....	R. A. Marr.	C.H. Sinclair.	21 34.193	21 34.171	0.022	21 34.182	+0.208	21 34.390	6	+0.047
Sept. 15....			.218	.164	.054	.191	....	.399	5	+ .038
Sept. 22....			.209	.247	.052	.278	....	.481	5	-- .044
Sept. 24....			.283	.224	.059	.254	....	.462	10	— .025
				Mean...	.047	21 34.225				
Sept. 26....	C.H. Sinclair.	R. A. Marr.	21 34.616	21 34.591	0.025	21 34.604	—0.208	.396	4	+ .041
Sept. 27....			.702	.673	.029	.687	....	.479	4	— .042
Sept. 28....			.667	.625	.042	.646	....	.438	5	— .001
Sept. 29....			.663	.619	.044	.641	....	.433	5	+ .004
				Mean...	.035	21 34.644...... ..		21 34.435		
					Weighted mean......			21 34.437		± 009

Transmission time, $0^s.020 \pm 0^s.002$.

Personal equation, Marr-Sinclair, $0^s.208 \pm 0^s.009$.

At Spokane, transit No. 19 was mounted in the grounds of the county court-house.

At Helena, transit No. 18 was mounted over the station in the northwest corner of the grounds of the United States assay office. The station was established in 1888. The court-house tower is $0^s.324$ or $4''.86$ east and $0''.811$ south of the transit.

$\Delta\,\lambda$ Spokane-Helena $= 21^m\ 34^s.437 \pm 0^s.009$.

λ Helena (transit 1888), $7^h\ 28^m\ 08^s.789 \pm 0^s.052$.

λ Spokane (transit), $7^h\ 49^m\ 43^s.226 \pm 0^s.053$.

$117^\circ\ 25'\ 48''.39 \pm 0''.80$.

From the foregoing it will be observed that the probable error of the longitude determination of the Spokane pier is 0″.80, or about 54 feet. Through a connection with the pier at Spokane the longitude of the meridian of the boundary line was established by triangulation and traverse, as will appear hereafter.

It may be remarked, in connection with the foregoing, that while the meridian of the Observatory at Washington is, by law approved September 28, 1850, the American meridian for all astronomical purposes, the geodetic operations of the country generally are conducted with reference to the meridian of Greenwich as an initial point. Government maps are usually referred to Greenwich, and standard time is reckoned from it.

SPOKANE BASE LINE.

A site for this base line was found in the valley of the Spokane River, east of the city of Spokane, points for its expansion being located on the surrounding hills. The line was measured along a tangent of the Northern Pacific Railway, beginning about 2.5 miles east of the Spokane depot and extending eastward 5 miles. It was prepared by nailing boards 1 by 6 by 60 inches 300 feet apart along the cross-ties parallel to the rail. On each board a smaller board (1 by 4 by 12 inches) was nailed, and on the latter was tacked a strip of zinc 2 by 10 inches. At night two complete measurements were made with United States Geological Survey steel tape No. 1, under a tension of 20 pounds, temperature being taken by reading three thermometers at each tape length. The front end of the tape was marked on the zinc strip with a fine brad awl. The length of the tape used, compared with the mural standard of the United States Coast and Geodetic Survey on October 30, 1895, was found to be 300.0075 feet; on December 5, 1896, 300.0058 feet. The mean of these two, 300.0067 feet, was adopted.

Adopted coefficient of expansion	F	.0000065
Mean temperature of first measurement		60°.35
Mean temperature of second measurement		59°.25
Difference between the two measurements, when corrected for temperature	feet	.006
Mean elevation of the line above sea level, as given by a profile furnished by the Northern Pacific Railway	feet	1,972
Length of base corrected for temperature	do	26,407.288
Correction for inclination	do	—0.156
Reduction to sea level	do	—2.491
Reduced length	do	26,404.641
Logarithm of length, in meters		3.9056962

The terminal points were transferred to the embankment 25 feet north of north rail, and the new points being intervisible, high tripod supports for the theodolite were necessary.

AZIMUTH.

The azimuth of the Spokane base line was determined by mounting 8-inch micrometer theodolite No. 300 over the west base and measuring the angle between Polaris and a mark placed at the east base. A series of observations, consisting of eighteen pointings (direct and reverse), was taken near elongation August 15, 1896, the resulting mean for azimuth west base-east base being 253° 18′ 45″.80.

With this value and the astronomic location of the cupola of the court-house at Spokane the positions of all triangulation stations and azimuths of all lines in the main belt of triangulation eastward to Divide and Scotchman stations, near the Idaho-Montana boundary line were computed. A check azimuth was observed at Divide triangulation station July 7, 1898, with the same theodolite. Twenty pointings (direct and reversed) on Polaris were obtained and referred to Scotchman station.

	°	′	″
Azimuth of line Divide-Scotchman computed from Spokane base	170	18	05.87
Azimuth of same line by direct observation	170	18	10.25
Difference			4.38

The observed value was adopted in the computation of positions in the extension of the triangulation northward to the international boundary.

Examples of record and computation for azimuth determination are given herewith:

Azimuth determinations at triangulation station Divide, July 7, 1898. S. S. Gannett, observer.

[Latitude (ϕ) 47° 57′ 57″.51. Longitude (λ) 116° 01′ 33″.08]

	Time.	Level. W. E.	Micrometer A.	Micrometer B.	Mean.	Angle.
	h. m. s.	d. d.	° ′ d.	° ′ d.	° ′ ″	° ′ ″
Azimuth mark	....	13.0 16.0	221 09 02	41 09 13	221 09 15	....
Polaris D	10 27 52	11.8 18.0	255 33 24	75 34 07	255 34 01	34 24 46
		24.8 34.0				
		—9.2				
Polaris R	10 33 48	13.8 15.3	75 36 08	255 34 21	75 35 29	....
Azimuth mark	....	14.0 15.0	41 09 18	221 08 11	41 08 59	34 26 30
		27.8 30.3				
		—2.5				
Azimuth mark	....	14.0 11.5	78 10 23	258 09 09	78 10 02	....
Polaris R	10 42 02	13.5 12.0	112 39 14	292 38 08	112 38 52	34 28 50
		27.5 23.5				
		+4.0				
Polaris R	10 46 08	16.0 16.0	292 40 02	112 40 11	292 40 13	....
Azimuth mark	....	18.2 14.0	258 09 28	78 10 14	258 10 12	34 30 01
		34.2 30.0				
		+4.0				

Time by mean time watch, 34 seconds fast on one hundred and fifth meridian time.

One division of striding level = 3″.66; 1 division of micrometer = 2″.00.

Level correction = $-\frac{d}{4}\left\{(w+w')-(e+e')\right\}\tan h$; d being the value of a division of the level, $w+w'$ readings of west end of level bubble, $e+e'$ readings of east end of level bubble, and h, the angular elevation of star, the foregoing formula reduces as follows:

$$\frac{3''.66}{4}\times\tan 47^\circ\ 57'\ 57''\ (1.11) = 1''.01.$$

The formula for reduction of azimuth observations at any hour angle is $\tan A = -\frac{a \sin t}{1-b \cos t}$, where $a=\sec \phi \cot \delta$, $b=\tan \phi \cot \delta$.

log sec ϕ, 47° 57′ 57″=0.17421 log tan ϕ=0.04505
log cot δ, 88° 45′ 46″=8.33439 log cot δ=8.33439
log a =8.50860 log b =8.37944

	m.	s.
Watch correction =	−0	34
Longitude correction =	−44	06
Total correction =	−44	40

	Computation of first observation.	Computation of second observation.	Computation of third observation.	Computation of fourth observation.
	h. m. s.	h. m. s.	h. m. s.	h. m. s.
Watch time of observation	10 27 52	10 33 48	10 42 02	10 46 08
Reduction to local meridian	−44 40	−44 40	−44 40	−44 40
Local mean time	9 43 12	9 49 08	9 57 22	10 01 28
Correction to sidereal	+1 36	+1 37	+1 38	+1 39
α of sun	7 03 11	7 03 11	7 03 11	7 03 11
Sidereal interval	16 47 59	16 53 56	17 02 11	17 06 18
α of Polaris	−1 21 51	−1 21 51	−1 21 51	−1 21 51
t	15 26 08	15 32 05	15 40 20	15 44 27
	° ′ ″	° ′ ″	° ′ ″	° ′ ″
t in arc	231 32 00	233 01 15	235 05 00	236 06 45
Log cos t	9.79383	9.77925	9.75769	9.74630
Log b	8.37944	8.37944	8.37944	8.37944
Log b cos t	8.17327	8.15869	8.13713	8.12574
b cos t	.01490	.01441	.01371	.01336
$1-b$ cos t	1.01490	1.01441	1.01371	1.01336
Log sin t	9.89375	9.90246	9.91381	9.91915
Log a	8.50860	8.50860	8.50860	8.50860
Log a sin t	8.40235	8.41106	8.42241	8.42775
Log $(1-b \cos t)$	0.00642	0.00621	0.00591	0.00575
Log tan A	8.39593	8.40485	8.41650	8.42200
	° ′ ″	° ′ ″	° ′ ″	° ′ ″
Azimuth of star	181 25 32	181 27 18	181 29 41	181 30 49
Angle to mark	−34 24 46	−34 26 30	−34 28 50	−34 30 01
Level correction	+9	+2	−4	−4
Azimuth of mark	147 00 55	147 00 50	147 00 47	147 00 44

The mean of twenty observations reduced in a similar manner = 147° 00′ 51″.15.

Check azimuths along the random line were measured with Young transit No. 6838. The instrument was usually set over one stadia station and a mark placed on another station. Six measurements (three direct and three reversed) of angle between Polaris and mark were then made. These observations were reduced at once by the method and tables given in the Manual of Surveying Instructions issued by the General Land Office, 1894, pages 109–119. An example of record and computation follows.

[July 19, 1898. Stadia ⊡ 77. D. L. Reaburn, observer.]

TELESCOPE DIRECT.

	Time.	A.	B.	Mean.	Angle.
	h. m. s.	° ′ ″	° ′ ″	° ′ ″	° ′ ″
Azimuth mark		0 03 30	180 03 30	0 03 30	
Polaris	9 03 40	1 19 00	1 18 30	1 18 45	1 15 15

TELESCOPE REVERSED.

Polaris	9 15 18	180 23 00	0 22 30	180 22 45	
Azimuth mark		180 02 30	180 02 30	0 02 30	1 20 15

TELESCOPE REVERSED.

Azimuth mark		35 14 00	215 14 00	35 14 00	
Polaris	9 30 00	36 38 30	216 38 30	36 38 30	1 24 30

TELESCOPE DIRECT.

Polaris	9 33 30	36 40 00	216 40 00	36 40 00	
Azimuth mark		35 14 00	215 14 00	35 14 00	1 26 00

TELESCOPE DIRECT.

Azimuth mark		81 12 00	261 12 00	81 12 00	
Polaris	9 39 45	82 39 00	262 39 00	82 39 00	1 27 00

TELESCOPE REVERSED.

Polaris	9 41 45	82 41 00	262 40 30	262 40 45	
Azimuth mark		81 12 00	261 11 30	81 11 45	1 29 00

[July 19, 1898. Stadia ⊡ 77. Latitude 48° 03′; longitude 116° 03′. Watch fast 42^m 36^s on local time.]

	H.	M.
Upper culmination Polaris, July 15	17	43.5
Reduction to July 18		−11.8
Upper culmination July 18, being culmination preceding time of observation on July 19	=17	31.7

[D. L. Reaburn, computer.]

	Computation of first observation.	Computation of second observation.	Computation of third observation.	Computation of fourth observation.	Computation of fifth observation.	Computation of sixth observation.
	h. m.	*h. m.*	*h. m.*	*h. m.*	*h. m.*	*h. m.*
Time of observation	9 03.7	9 15.3	9 30.0	9 33.5	9 39.7	9 41.7
Watch correction	−42.6	−42.6	−42.6	−42.6	−42.6	−42.6
Local mean time	8 21.1	8 32.7	8 47.4	8 50.9	8 57.1	8 59.1
	+24	+24	+24	+24	+24	+24
	32 21.1	32 32.7	32 47.4	32 50.9	32 57.1	32 59.1
Subtract up. culmination	−17 31.7	17 31.7	17 31.7	17 31.7	17 31.7	17 31.7
Hour angle	14 49.4	15 01.0	15 15.7	15 19.2	15 25.4	15 27.4
Subtract from	23 56.1	23 56.1	23 56.1	23 56.1	23 56.1	23 56.1
Time argument	9 06.7	8 55.1	8 40.4	8 36.9	8 30,7	8 28.7
Azimuth Polaris—	° ′ ″	° ′ ″	° ′ ″	° ′ ″	° ′ ″	° ′ ″
At observation	181 13 45	181 18 30	181 23 12	181 24 16	181 26 00	181 27 00
Angle to mark	1 15 15	1 20 15	1 24 30	1 26 00	1 27 00	1 29 00
Azimuth of mark	179 58 30	179 58 15	179 58 42	179 58 16	179 59 00	179 58 00

Mean = 179° 58′ 33″ showing this portion of the random line to deviate from the true meridian by 1′ 27″.

TRIANGULATION.

The triangulation connecting the Spokane base with the boundary line was done with an 8-inch micrometer theodolite, reading by two micrometers to two seconds and by estimation to one second. Directions were read in sets, each set consisting of pointings with telescope direct and reversed from left to right and from right to left. Four or more of such sets were usually taken. A few secondary locations on or near the boundary line were made with the transit. All of the observations were reduced in the office by least squares.

The following list gives descriptions, latitude, longitude, azimuths, and distances of the triangulation stations determined which have a bearing on the boundary line.

A diagram of the triangulation is also presented. (See Pl. V.)

SPOKANE, EAST BASE.

Station mark: A dressed stone, 7 by 7 by 36 inches, set 30 inches in ground, 25 feet north of north rail, and 94 feet eastward from sign marked "Trent 1 mile." The stone is marked on top
"U. S.
+
E. Base."

[Latitude, 47° 41′ 01″.94. Longitude, 117° 16′ 00″.81.]

To station—	Azimuth.	Back azimuth.	Log. distance.
	° ′ ″	° ′ ″	*Meters.*
Moran	14 37 16.02	194 35 48.17	3.9929426
West base	73 23 19.07	253 18 45.80	3.9056962
Court-house cupola	80 02 46.43	259 55 31.41	4.0956581
Little Baldy	117 19 24.54	297 16 30.04	3.7432302
Skalan	288 10 38.61	108 22 55.95	4.3409600

SPOKANE, WEST BASE.

Station mark: A dressed stone, 7 by 7 by 36 inches, set 30 inches in the ground, 25 feet of north rail and 218 feet eastward from signboard, "R. R. X'ng ½ mile." Top of the stone is marked

"U. S.
+
W. Base."

[Latitude, 47° 39′ 47″.28. Longitude, 117° 22′ 10″.45.]

To station—	Azimuth.	Back azimuth.	Log. distance.
	° ′ ″	° ′ ″	*Meters.*
Court-house cupola	91 45 38.07	271 42 56.36	3.6595819
Tomkinson	137 10 30.83	317 06 36.14	3.9881446
Little Baldy	209 54 21.35	29 56 00.21	3.7474231
East base	253 18 45.80	73 23 19.07	3.9056962
Skalan	278 57 36.00	99 14 26.34	4.4609400
Moran	324 00 35.75	144 03 41.01	3.9500715

COURT-HOUSE CUPOLA, SPOKANE.

(Not occupied.)

This point is connected, by direct measurement, with longitude pier of the United States Coast and Geodetic Survey of 1888 and with latitude pier of the United States Geological Survey of 1896. It is also connected, by triangulation, with the stations of the base expansion. The point located is the center of the flagstaff, which is over the center of the cupola of the new court-house.

Latitude, 47° 39′ 51″.76. Longitude, 117° 25′ 49″.21.

MORAN, SPOKANE COUNTY.

Location of station: On the northern end of a high, wooded ridge, about 8 miles southeast of Spokane, in a cleared field about 50 feet west of the ruins of a log cabin. A wagon road runs to the station.

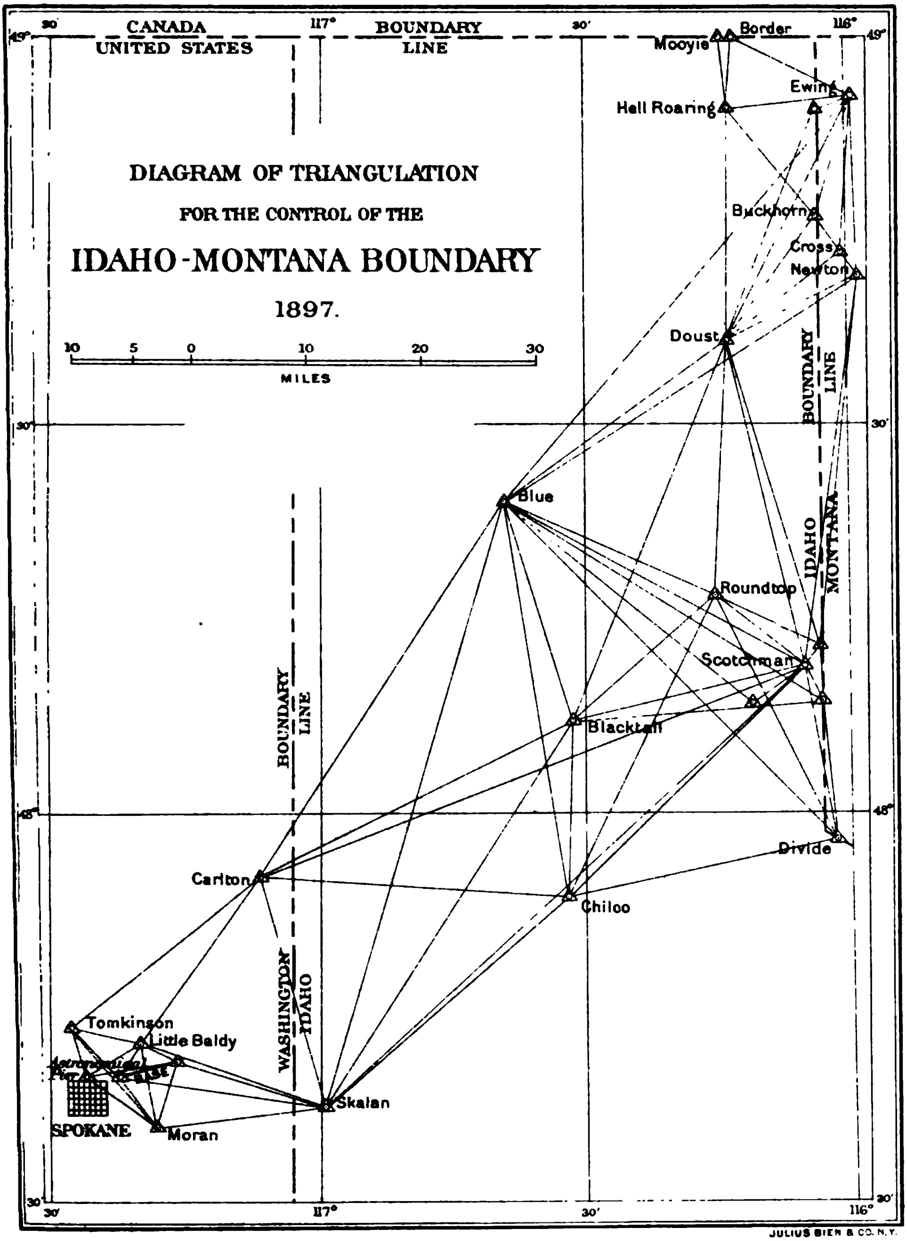


DIAGRAM OF TRIANGULATION

FOR THE CONTROL OF THE

IDAHO-MONTANA BOUNDARY

1897.

JULIUS BIEN & CO. N.Y.

Station mark: A dressed stone, 8 by 8 by 36 inches, set 30 inches in the ground, marked "U. S. △."

[Latitude, 47° 35′ 53″.67. Longitude, 117° 17′ 59″.70.]

To station—	Azimuth.	Back azimuth.	Log. distance.
	° ′ ″	° ′ ″	*Meters.*
Court-house cupola	126 55 28.15	306 49 41.22	4.0882682
Tomkinson	140 29 39.00	320 22 39.05	4.2697837
Little Baldy	168 33 40.57	348 32 14.04	4.0900766
Skalan	263 25 05.73	83 38 50.36	4.3704936

LITTLE BALDY, SPOKANE COUNTY.

Location of station: On a small flat-topped hill 5 miles northeast of Spokane, and in the center of a cleared field on the highest part of hill. A fringe of tall pine trees extends around the hill.

Station mark: A dressed stone, 8 by 8 by 36 inches, set 30 inches in the ground, marked "U. S. △."

[Latitude, 47° 42′ 24″.16. Longitude, 117° 19′ 56″.74.]

To station—	Azimuth.	Back azimuth.	Log. distance.
	° ′ ″	° ′ ″	*Meters.*
Court-house cupola	57 24 18.29	237 19 57.66	3.9409362
Tomkinson	103 43 22.18	283 37 48.45	3.9857308
Mount Carlton	214 13 32.20	34 23 09.80	4.4590100
Skalan	289 58 08.50	110 13 20.40	4.4378494
East base	297 16 30.04	117 19 24.54	3.7432302

TOMKINSON, SPOKANE COUNTY.

Location of station: On the southern part of a small table-land 4 miles north of Spokane, on the highest knoll in pasture of Mr. Tomkinson and one-eighth of a mile southwest of his house.

Station mark: A dressed stone, 8 by 8 by 36 inches, set 30 inches in the ground, marked "U. S. △."

[Latitude, 47° 43′ 38″.24. Longitude, 117° 27′ 27″.85.]

To station—	Azimuth.	Back azimuth.	Log. distance.
	° ′ ″	° ′ ″	*Meters.*
Carlton	229 52 16.64	50 07 28.61	4.5239434
Court-house cupola	343 36 09.45	163 37 22.41	3.8627730

SKALAN, KOOTENAI COUNTY, IDAHO.

Location of station: Twenty miles east of Spokane, Washington, and 3 miles east of Washington-Idaho boundary line. The summit is a bald, rocky ridge, and can be reached by a good trail from Dr. Dennison's ranch, on the east side of Skalan Creek.

Station mark: A copper bolt set in solid rock, above which is a cairn 5 feet in diameter at base and 5 feet in height.

[Latitude, 47° 37′ 19″.26. Longitude, 116° 59′ 23″.15.]

To station—	Azimuth.	Back azimuth.	Log. distance.
	° ′ ″	° ′ ″	*Meters.*
Moran	83 38 50.36	263 25 05.73	4.3704936
Little Baldy	110 13 20.40	289 58 08.50	4.4378494
Carlton	164 08 34.00	344 02 57.76	4.5378730
Blacktail	212 17 12.70	32 38 06.17	4.8158528
Chilco	228 45 58.75	49 06 20.29	4.6587750

CARLTON, SPOKANE COUNTY, WASHINGTON.

Location of station: About 35 miles by road and trail northeast of Spokane, Washington. The mountain has two summits of nearly equal height and about one-third of a mile apart. The station is on the southern summit, which is flat and bald, but has a growth of pine and spruce trees on its western side. There is a good trail to station from The Meadows.

Station mark: A copper bolt set in solid rock, above which is a rock cairn 5 feet in diameter and 5 feet in height.

[Latitude, 47° 55′ 13″.71. Longitude, 117° 06′ 57″.26.]

To station—	Azimuth.	Back azimuth.	Log. distance.
	° ′ ″	° ′ ″	*Meters.*
Little Baldy	34 23 09.49	214 13 31.91	4.4589864
Tomkinson	50 07 28.61	229 52 16.64	4.5239434
Blacktail	243 24 10.03	63 50 44.00	4.6954456
Chilco	274 01 32.58	94 27 33.97	4.6416575
Skalan	344 02 57.76	164 08 34.00	4.5378730

BLACKTAIL, KOOTENAI COUNTY, IDAHO.

Location of station: On a bald point near the south end of summit, near the western shore of Lake Pend Oreille and east of Cocolalla, on

Northern Pacific Railway. It can be easily reached by trail from T. Trumbull's ranch.

Station mark: A copper bolt sunk in solid rock, above which is a cairn 5 feet in diameter and 5 feet in height.

[Latitude, 48° 07′ 07″.09. Longitude, 116° 31′ 13″.03.]

To station—	Azimuth.	Back azimuth.	Log. distance.
	° ′ ″	° ′ ″	*Meters.*
Chilco	1 53 09.56	181 52 39.78	4.4029303
Skalan	32 38 06.17	212 17 12.70	4.8158528
Carlton	63 50 44.00	243 24 10.63	4.6954456
Round Top	228 10 27.76	48 22 33.96	4.4305996
Scotchman	256 22 33.71	76 42 07.01	4.5246835

CHILCO, KOOTENAI COUNTY, IDAHO.

Location of station: On the south end of grassy summit south of the steamboat landing on Lake Pend Oreille. It can be easily reached from Collins's ranch by Leiberg trail.

Station mark: A copper bolt sunk in solid rock, above which is a rock cairn 5 feet in diameter at base and 5 feet in height.

[Latitude, 47° 58′ 28″.75. Longitude, 116° 31′ 53″.09.]

To station—	Azimuth.	Back azimuth.	Log. distance.
	° ′ ″	° ′ ″	*Meters.*
Skalan	49 06 20.29	228 45 58.75	4.6587752
Carlton	94 27 33.97	274 01 32.58	4.6416575
Blacktail	181 52 39.78	1 53 09.56	4.4029303
Round Top	205 48 07.02	26 00 41.75	4.6816159
Scotchman	225 10 00.98	45 30 01.97	4.6724527
Divide	257 25 15.62	77 47 46.64	4.5875062

SCOTCHMAN, KOOTENAI COUNTY, IDAHO.

Location of station: On the southwestern of three summits, about a mile west of the Idaho-Montana boundary line and 6 miles northeast of Clark Fork, a station on the Northern Pacific Railway. It can be reached from Lightning Creek by an old Indian trail—a roundabout way, though the easiest one.

Station mark: A copper bolt in solid rock, above which is a rock cairn 5 feet in diameter and 5 feet in height.

[Latitude, 48° 11′ 19″.36. Longitude, 116° 04′ 58″.02.]

To station—	Azimuth.	Back azimuth.	Log. distance.
	° ′ ″	° ′ ″	*Meters.*
Chilco	45 30 01.97	225 10 00.98	4.6724527
Blacktail	76 42 07.01	256 22 33.71	4.5246835
Round Top	129 21 22.70	309 13 54.54	4.2047087
Divide	350 15 33.38	170 18 05.87	4.4001417

ROUND TOP, KOOTENAI COUNTY, IDAHO.

Location of station: Northeast of Hope, on the Sherry trail, near Hogeye camp, on the southern end of the summit, which extends 100 yards north and south.

Station mark: A copper bolt sunk in rock, above which is a rock cairn 5 feet in diameter and 5 feet in height.

[Latitude, 48° 16′ 47″.86. Longitude, 116° 14′ 58″.88.]

To station—	Azimuth.	Back azimuth.	Log. distance.
	° ′ ″	° ′ ″	*Meters.*
Chilco	26 00 41.75	205 48 07.02	4.6816159
Blacktail	48 22 33.96	228 10 27.76	4.4305996
Scotchman	309 13 54.54	120 21 22.70	4.2047087
Divide	334 24 02.60	154 34 02.58	4.5855553

DIVIDE (1).

Location of station: On a knoll on divide of the Bitterroot Mountains on the boundary line between Idaho and Montana. It is not the highest point, but it is almost cleared of timber. Station is best reached from Heron, Montana, by the Elk Creek trail.

Station mark: A copper bolt sunk in solid rock, above which is a rock cairn 3 feet in height and 3 feet in diameter.

[Latitude, 47° 57′ 57″.51. Longitude, 116° 01′ 33″.08.]

To station—	Azimuth.	Back azimuth.	Log. distance.
	° ′ ″	° ′ ″	*Meters.*
Chilco	77 47 46.64	257 25 15.62	4.5875062
Round Top	154 34 02.58	334 24 02.60	4.5855553
Scotchman	170 18 05.87	350 15 33.38	4.4001417

MOOYIE TRAIL MONUMENT.

On or near the boundary line between Kootenai County, Idaho, and British Columbia, about 32 miles northward from Bonners Ferry.

Easily reached by the new Wild Horse trail, 5 miles from Round Meadows or Prairie. Monument is about a half mile beyond a portion of trail filled with loose rocks, and just beyond a heavy growth of timber and underbrush. Where the trail crosses the international boundary there is a large tree squared about 4 feet above the ground. On the south side of the tree are cut the letters "U. S.," on the north side the letters "B. C." Monument is west of this tree.

Station mark: Copper bolt sunk in soil, over which is a monument of loose stone and a tree 20 feet in height.

[Latitude, 49° 00′ 01″.51. Longitude, 116° 14′ 19″.48.]

To station—	Azimuth.	Back azimuth.	Log. distance.
	° ′ ″	° ′ ″	*Meters.*
Border	267 48 09.25	87 49 12.16	3.22930
Hell Roaring	353 09 44.78	173 10 30.25	4.01339

BLUE, KOOTENAI COUNTY, IDAHO.

Location of station: On southeasternmost of three summits of nearly equal height, 5½ miles west of Sand Point, on Great Northern Railway, 7 miles west of Sand Point, on Northern Pacific Railway; eight hours' travel from Carr's ranch, on Rider Creek, passing "Old Baldy," thence along ridge.

Station mark: Copper bolt in solid rock, over which is a rock cairn 5 feet in height.

[Latitude, 48° 24′ 01″.52. Longitude, 116° 38′ 55.″78.]

To station—	Azimuth.	Back azimuth.	Log. distance.
	° ′ ″	° ′ ″	*Meters.*
Doust	232 53 14.44	53 12 26.21	4.5965347
Newton	236 01 09.17	56 31 23.44	4.7758946
Scotchman	299 03 30.80	119 28 52.14	4.6825857
Blacktail	343 00 37.10	163 06 22.39	4.5152727

DOUST, KOOTENAI COUNTY, IDAHO.

Location of station: About 7 miles southeast from Bonners Ferry. Best reached from Wright's ranch, in Paradise Valley. Follow trail leading to mineral claims of Doust & Wright to summit of Wright Mountain, thence along ridge over fallen timber to station; three hours' travel.

Station mark: Copper bolt in solid rock, above which is a rock cairn 5 feet in height.

[Latitude, 48° 36′ 50″.16. Longitude, 116° 13′ 18″.15.]

To station—	Azimuth.	Back azimuth.	Log. distance.
	° ′ ″	° ′ ″	*Meters.*
Blacktail	21 59 49.24	201 46 25.83	4.7734417
Blue	53 12 26.21	232 53 14.44	4.5965347
Hell Roaring	179 57 47.07	359 57 46.29	4.5150730
Ewing	206 31 13.33	26 41 59.63	4.5929986
Cross	232 19 53.73	52 29 34.08	4.3000841
Newton	242 25 12.51	62 36 15.35	4.3089562
Scotchman	347 40 26.39	167 46 40.40	4.6847536

HELL ROARING, KOOTENAI COUNTY, IDAHO.

Location of station: On southern end of the eastern of two round peaks at the head of Hell Roaring Creek. From Round Prairie a trail runs south of Hell Roaring Creek to summit of mountain.

Station mark: Copper bolt in solid rock, above which is a rock cairn 4½ feet high.

[Latitude, 48° 54′ 30″.02. Longitude, 116° 13′ 19″.18.]

To station—	Azimuth.	Back azimuth.	Log. distance.
	° ′ ″	° ′ ″	*Meters.*
Mooyie Trail monument	173 10 30.25	353 09 44.78	4.01339
Border	182 36 16.26	2 36 33.65	4.01348
Ewing	262 28 39.26	82 39 27.78	4.2471106
Cross	322 24 20.27	142 34 02.70	4.4137728
Doust	359 57 46.29	179 57 47.07	4.5150730

SCOTCHMAN (2), KOOTENAI COUNTY, IDAHO.

A secondary station near boundary post No. 72, at summit of Cabinet Mountain, occupied with transit.

[Latitude, 48° 12′ 50″.40. Longitude, 116° 08′ 14″.98.]

To station—	Azimuth.	Back azimuth.	Log. distance.
	° ′ ″	° ′ ″	*Meters.*
Scotchman	37 07 25	217 06 08	3.54730
Divide	355 37 01	175 38 16	4.44183
Transit station 154	357 34 30	177 34 42	3.87099

BUCKHORN, KOOTENAI COUNTY, IDAHO.

A secondary station near boundary post No. 23, at summit of Yak Mountain, occupied with transit.

[Latitude, 48° 46′ 22″.57. Longitude, 116° 03′ 16″.03.]

To station—	Azimuth.	Back azimuth.	Log. distance.
	° ′ ″	° ′ ″	*Meters.*
Doust	34 55 05.20	214 47 32.90	4.33338
Transit station 949	181 09 14.60	1 09 25.90	4.18013
Newton	325 15 17.30	145 18 48.30	4.00320
Ewing	196 47 42.90	16 51 04.97	4.25810
Cross	327 38 03.50	147 40 20.26	3.81428

BLACKTOP, KOOTENAI COUNTY, IDAHO.

A secondary station near boundary post No. 74. Reached from Clark Fork, Idaho, by trail to Homestake cabin; thence to divide between Blue and Mosquito creeks; then by four hours' travel (on foot) to station, following along slope of mountain.

Station mark: Cross cut on solid rock, under a rock monument 3 feet in height.

[Latitude, 48° 11′ 50″.72. Longitude, 116° 03′ 49″.28.]

To station—	Azimuth.	Back azimuth.	Log. distance.
	° ′ ″	° ′ ″	*Meters.*
Scotchman	55 42 20	235 41 29	3.23516
Transit station 154	349 37 02	169 37 39	3.75359

NEWTON, FLATHEAD COUNTY, MONTANA.

Location of station: On second summit southeast of Newton Pass, on trail from Newton's ranch to Sylvanite.

Station mark: Iron bolt in solid rock, above which is a rock cairn 5 feet in height.

[Latitude, 48° 41′ 54″.51. Longitude, 115° 58′ 35″.26.]

To station—	Azimuth.	Back azimuth.	Log. distance.
	° ′ ″	° ′ ″	*Meters.*
Scotchman	7 56 25.44	187 51 39.02	4.7576096
Blue	56 31 23.44	236.01 09.17	4.7758946
Doust	62 36 15.35	242 25 12.51	4.3089562
Cross	140 57 32.97	320 56 10.82	3.5525754
Ewing	178 55 40.21	358 55 22.48	4.4087123

EWING, FLATHEAD COUNTY, MONTANA.

Location of station: In extreme northwestern corner of State, about 35 miles northeast of Bonners Ferry, Idaho. It can be reached by trail to Buckhorn mines, thence along divide 4 miles to break-off, thence northeast down into the basin or meadows, thence ascending ridge in northwest direction, thence along ridge to summit.

Station mark: Copper bolt in loose rock, above which is cairn of rocks 4½ feet high.

[Latitude, 48° 55′ 43″.99. Longitude, 115° 58′ 58″.82.]

To station—	Azimuth.	Back azimuth.	Log. distance.
	° ′ ″	° ′ ″	*Meters.*
Cross	4 25 15.00	184 24 09.92	4.3602056
Buckhorn	16 51 04.97	196 47 42.90	4.2581050
Doust	26 41 59.63	206 31 13.33	4.5929986
Transit station 949	65 56 28.90	245 53 26.30	3.7325500
Hell Roaring	82 39 27.78	262 28 39.26	4.2471106
Border	115 18 08.80	295 07 37.22	4.2747300
Newton	358 55 22.48	178 55 40.21	4.4087124

CROSS, FLATHEAD COUNTY, MONTANA.

Location of station: On first summit northwest of Newton Pass, on trail between Sylvanite and Newton's ranch.

Station mark: Copper bolt in loose rocks, above which is cairn of rocks 4½ feet high.

[Latitude, 48° 43′ 24″.24. Longitude, 116° 00′ 25″.26.]

To station—	Azimuth.	Back azimuth.	Log. distance.
	° ′ ″	° ′ ″	*Meters.*
Doust	52 29 34.08	232 19 53.73	4.3000841
Hell Roaring	142 34 02.70	322 24 20.27	4.4137728
Buckhorn	147 40 20.26	327 38 03.50	3.8142800
Ewing	184 24 09.92	4 25 15.00	4.3602056
Newton	320 56 10.32	140 57 32.97	3.5525754

BORDER, IN CANADA.

Location of station: Just north of Kootenai County, Idaho. Reached from the Mooyie Trail by a trail to Grierson's ranch; thence by Indian trail to small lake lying to the east; thence around lake to ridge; thence up ridge to station.

Station mark: Copper bolt in solid rock, above which is a rock cairn 4½ feet high.

[Latitude, 49° 00′ 03″.60. Longitude, 116° 12′ 56″.12.]

To station—	Azimuth.	Back azimuth.	Log. distance.
	° ′ ″	° ′ ″	*Meters.*
Hell Roaring	2 36 33.65	182 36 16.26	4.01348
Mooyie	87 49 12.16	267 48 09.25	3.22930
Ewing	295 07 37.22	115 18 08.80	4.27473

TRANSIT STATION 154.

A secondary station near boundary post No. 78; best reached by trail from Clark Fork, Idaho, by way of the Homestake cabin, to Blue Creek; two hours' travel to cabin, one and one-half hours from cabin to camp on Blue Creek. The ridge leading from Blue Creek to the station can be ascended on the south side in one and one-half hours.

Station mark: Copper bolt in rock, over which is a rock cairn 3 feet in height.

[Latitude, 48° 08′ 50″.14. Longitude, 116° 02′ 59″.84.]

To station—	Azimuth.	Back azimuth.	Log. distance.
	° ′ ″	° ′ ″	*Meters.*
Blacktail	84 58 53	264 37 52	4.54599
Scotchman	152 05 45	332 04 17	3.71732
Scotchman (2)	177 34 42	357 34 30	3.87099
Divide	354 53 39	174 54 44	4.30621

TRANSIT STATION 949, NEAR IDAHO-MONTANA BOUNDARY LINE.

A secondary station on a large hill near boundary post No. 9, 6½ miles south of international boundary.

Station mark: None.

Reference mark: Signal tree, distant 138 feet, azimuth to which is 308° 55′.

[Latitude, 48° 54′ 32″.59. Longitude, 116° 03′ 01″.05.]

To station—	Azimuth.	Back azimuth.	Log. distance.
	° ′ ″	° ′ ″	*Meters.*
Buckhorn	1 09 25.9	181 09 14.6	4.18013
Doust	21 04 28.9	200 56 39.8	4.54598
Ewing	245 53 26.3	65 56 28.9	3.73255

DIVIDE (2).

This triangulation station is not on the meridional portion of the line, but on the crest of the Bitterroot Mountains, farther south, and was located in connection with the survey of the Bitterroot Forest Reserve.

It is on the main summit of the Bitterroot Range, on the boundary line between Montana and Idaho, 20 miles (air line) west of Grantsdale. It can be reached from the Lost Horse Pass (camp being at Twin Lakes) by following the northwest face of the mountain northeast from the Twin Lakes to the crossing of Moose Creek, thence up the creek to the Meadows. The peak lies to the northwest, about 2,000 feet above the meadow.

Station mark: A rock cairn 5 feet in diameter and 8 feet in length.

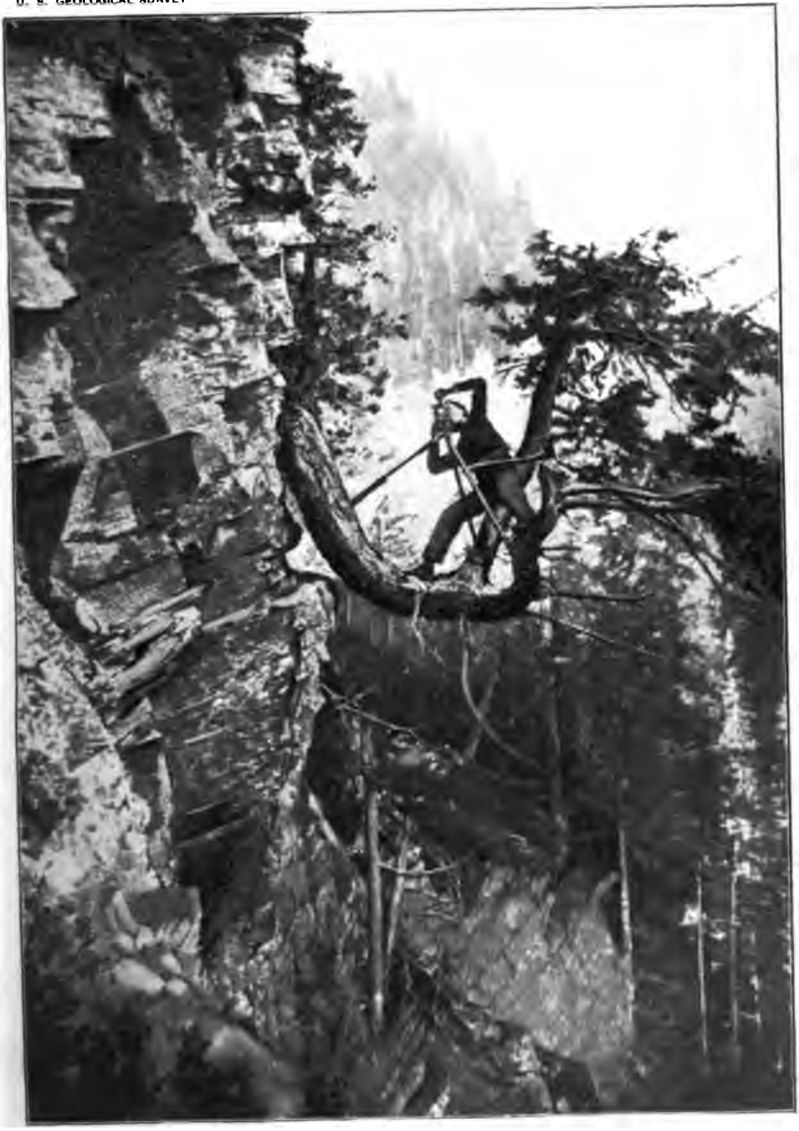
[Latitude, 46° 11′ 32″.1. Longitude, 114° 28′ 12″.2.]

To station—	Azimuth.	Back azimuth.	Log. distance.
	° ′ ″	° ′ ″	*Meters.*
Ward (2)	279 32 28	99 40 31	4.16360
El Capitan	344 06 39	164 09 53	4.32652

TRANSIT AND STADIA WORK.

The transit used was one manufactured by Young & Sons, of the type known as No. 10 mountain transit, the maker's number being 6838. The horizontal circle was 4¾ inches, and this circle, as well as the vertical circle, was graduated to read with verniers to 1′. The instrument was provided with a compass attachment, fixed stadia wires, and a tripod with extension legs. The extension legs were at times very necessary, as may be seen from Pl. VI. Two stadia rods, of seasoned white pine, three-fourths inch in thickness, 12 feet in length, and 4 inches across the faces, were made in Spokane. The lower portions of the rods were tapered to a point and shod with steel. The design of the rod was black on a white ground. (See fig. 1.) By a series of tests the stadia interval was found to be in the ratio of 1 foot on the rod to 100 feet horizontal distance, as nearly as could be determined, and the rods were graduated to even feet and tenths. The extreme divisions of the rods included 10 feet, and each tenth was divided into five parts, so that hundredths could be easily read by estimation. No numbers were placed on the rods. In practice the rods were held vertically, proper corrections being applied for reducing all sights to the horizontal.

There was no expectation of obtaining exact independent results for distances measured with the transit and stadia upon the basis of the stadia wires in the transit being set in the ratio of 1 to 100 and the



TRANSIT STATION ON RANDOM LINE.

rods being divided so as to read to hundredths. In point of fact, probably neither of these conditions existed, even when the instrument was fresh from the hands of the maker and when the rods were newly graduated at Spokane, and much less likely is it that they existed when the instrument was subject to rough field usage and the rods were used under entirely different and variable circumstances. It was believed, however, that they could be relied upon in determining intermediate distances between points the exact distances between which were known, and so long as the ratio between the wire interval and the graduated portions of the rods remained nearly constant the purpose intended to be subserved would be accomplished. Thus, when a line was run with the stadia between two points whose positions were rigidly fixed by triangulation and the resulting error was proportionately distributed, sufficiently accurate results were obtained, much more nearly accurate than could have been obtained by chaining, especially after certain corrections had been applied.

The method used in running the random line was as follows:

The line started from an astronomic azimuth, the initial point being on a high ridge and marked with a large signal. This signal was, when possible, used as a backsight, the instrument being transited in the direct and reversed position and the mean of the two points determined for the foresight being adopted. Of course in a timbered country it was generally not possible to see the backsights for any great distance, but whenever a ridge was crossed the trees were cut out (see Pls. IX and X) and a new backsight was established. In addition, frequent observations for astronomical azimuth were made, and thus additional checks were obtained. If any considerable discrepancy was discovered between the astronomical azimuth and the instrumental line, the latter was rerun in order to obtain a satisfactory check. Further, the line was connected with the triangulation and accurately adjusted thereto in azimuth as well as in distance. When the line was adjusted to the triangulation it was apparent that the transit man had introduced into his work a decided personal equation, which had the effect of constantly swinging his line in azimuth too far to the westward, as will appear hereafter. The stadia distances were read from both backsights and foresights, so that the length of each sight was obtained in duplicate, one distance depending on rod No. 1 and the other on rod No. 2, the mean being adopted. In the same

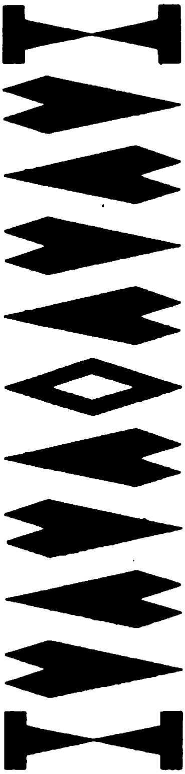


FIG. 1.—Design for stadia rod.

way vertical angles were checked by reading backsights and foresights; and thus levels were carried over the whole line. The height of the instrument above the ground station was determined at each point, and a corresponding height was sighted on the stadia rods. This height was obtained by having one of the legs of the tripod marked to tenths of a foot and by using the plumb bob as a measuring line.

The magnetic declination was read at each transit station.

The stadia line was divided into four sections:

First section. This section extended from the zero of the random line, namely, the summit of the Bitterroot Mountains, to transit station 154, and was controlled by connection with the triangulation system at both terminal points. At the summit of the Bitterroot Mountains it was connected by traverse with the triangulation station Divide, and transit station 154 was located directly by triangulation. The distance determined by stadia was 62,071 feet, and by triangulation 62,276 feet, the discrepancy being 205 feet, or 1 in 304. The azimuth correction in this section was found to be 0° 0′ 33″, corresponding to a swing of 10 feet to the east in the random line at station 154 in order to make it a true meridian line.

Second section. This section was included between stations 154 and 800. Station 800 was connected by a short traverse with the triangulation station Buckhorn. The distances determined by stadia and triangulation were, respectively, 228,014 and 228,734 feet, the difference being 720 feet, or 1 in 318. The azimuth swing at station 800 was 71 feet to the east, corresponding to an angular correction of 0° 01′ 04″.

Third section. This section was between stations 800 and 949. Station 949 was located directly by triangulation. The distance by stadia was 49,132 feet and by triangulation 49,190 feet, the difference being 58 feet, or 1 in 848. The swing in azimuth at station 949 amounted to 12.5 feet to the east, corresponding to an angular correction of 0° 0′ 52″.4.

The positions of transit stations 0, 154, 800, 949, and 1046 correspond approximately to those of monuments 92, 78, 23, 8, and 0, respectively.

Fourth section. This section closed on the international boundary, and it was unfortunate that a location by triangulation could not be obtained near its terminus, but the nature of the country rendered such a location impracticable, there being no elevated points near by and the timber being very tall and dense. It was therefore checked by careful steel-tape measurements, the tape being held horizontally under a constant tension of about 15 pounds, a plumb bob being used at each end. This section extended between station 949 and a point 45 feet north of station 1046. The distance by stadia was 33,103 feet and by steel-tape measurement 33,219 feet, the discrepancy being 116 feet, or 1 in 286.

It is proper to add that there are two small corrections which should have been applied to the distance obtained and used on this section, one being that for reduction to sea level, amounting to —8 feet, and the other that for reduction on account of tape, which, after comparison with the United States Coast and Geodetic Survey standard, was found to be +12 feet. Thus, theoretically, the monument was placed 4 feet too far north, but the error, compared with that which might result from unavoidable station error, is so small that it may be considered as negligible.

It might be well to explain what is meant by "station error." It is the error which is more or less inherent in all astronomic determinations, being caused by the deviation of the plumb bob, on account of varying local attractions, from the true vertical. Its existence may be detected by direct measurements between two astronomic stations. Assuming an astronomic location to be made at *A*, a connection by triangulation with another station, *B*, and the position of *B* thus deduced from that of *A*, then if the astronomic position of *B* is determined, the discrepancy between the astronomic position and the position determined by triangulation from *A* represents the combined station error. Efforts have been made to deduce a law, based on the contour and density of adjacent land forms, which shall define the amount of attraction affecting the plumb bob which might be expected in any particular case, but nothing satisfactory has been accomplished, owing principally to the fact that it is impossible to give an accurate value to the various components which constitute the mass of any given section of the earth's crust.

The following table gives the results obtained directly from the stadia, and which were used in reducing the random line to the true line, both in distance and in azimuth. These figures do not, however, represent the degree of precision obtained by the stadia in measuring the distances, as they are unaffected by any corrections.

Table showing discrepancy between computed and measured distances, also discrepancy in azimuth.

Section.	Stations.	Computed distance.	Stadia distance.	Latitudinal discrepancy.	Discrepancy.	Longitudinal discrepancy, random line west of true line.	Discrepancy.	Mean angular error in azimuth.
		Feet.	*Feet.*	*Feet.*		*Feet.*		° ′ ″
1	0-154	62,276	62,071	205	1 in 304	10	1 in 6,228	0 0 33
2	154-800	228,734	228,014	720	1 in 318	71	1 in 3,222	0 1 04
3	800-949	49,190	49,132	58	1 in 848	12.5	1 in 3,927	0 0 53

The distances measured by the stadia should be corrected before any satisfactory comparison can be made with the computed distances for the purpose of testing the accuracy of the stadia work.

Two conditions will be considered. The first is based upon the supposition that the rods were graduated arbitrarily into regular divisions, which were sufficiently small to admit of reading distances approximately to a foot, and that the stadia wires were set at some fixed interval. The fact that the rods were actually graduated so as to be read, as nearly as might be, to feet, tenths, and hundredths, and that the wire interval was approximate in the ratio of 1 to 100, does not enter at all into the theory of this condition. In fact the rod might be graduated in any systematic manner and the wires placed at any fixed interval without affecting the results after the proper corrections had been applied. An analogous case would be one in which certain distances were measured with a chain or tape the exact length of which was not known at the time the measurement was made but which was afterwards determined and the correction applied. The tape might prove to be 99 feet in length, but this would not affect the ultimate results after proper allowance had been made. The fourth section of the boundary line furnished a means by which the relation between the distances determined by the stadia and careful measurements with a steel tape, in other words, the stadia factor, might be ascertained.

Table of comparisons of stadia and steel-tape measurements from transit station 949 (post 8) to the international boundary (post 0), section 4.

Location.	Steel tape.	Stadia.	Difference.	Discrepancy.
	Feet	*Feet.*	*Feet.*	
Station 949	0	0	0	
Post 7	4,618.6	4,601.5	17.1	1 in 270
Post 6	8,606	8,572	34	1 in 253
Post 5	13,760.5	13,698	62.5	1 in 220
Post 4	18,148.3	18,077	71.3	1 in 254
Post 3	23,596.2	23,512	84.2	1 in 280
Post 2	27,153	27,062.5	90.5	1 in 300
Post 1	31,106	31,000	106	1 in 293
Post 0	33,219	33,103	116	1 in 286

An inspection of the foregoing table will develop the fact that the ratio existing between the results from the steel-tape and the stadia measurements is fairly constant. The steel-tape measurements were carefully made with a 100-foot steel tape, under conditions approximating those under which the other portions of the line were measured independently by the stadia, except that the surface was probably not so broken and the change of elevation not so great, thus favoring the accuracy of the tape measurement. The steel tape was afterwards compared with the United States Coast and Geodetic Survey standard, and the values in the table are affected by a small correction necessary to reduce them to the standard. Thus the comparison may be considered as determining the stadia factor, or the amount by which each stadia distance should be corrected in order to reduce it to a true measurement.

It appears from the table that in a distance of 33,219 feet the stadia measurement was 33,103 feet, or a difference of 116 feet, which corresponds to 1 in 286; this correction to be added to the stadia results.

It might be argued that it would be preferable to obtain the stadia factor by direct comparison with the computed lengths of the lines in sections 1, 2, and 3; and so it would if the rods were to be used for other purposes, but for the present purpose, which is to make a comparison between the computed distances and the direct stadia measurements, the other method is adopted.

Table showing discrepancies between stadia distances corrected for stadia factor and computed distances.

Section.	Stations.	Stadia distance reduced to mean sea level.	Correction for stadia factor, 1 in 286.	Corrected stadia distance.	Computed distance.	Discrepancy; add to stadia distance.	Discrepancy.
		Feet.	*Feet.*	*Feet.*	*Feet.*	*Feet.*	
1.......	0–154	62,061	+217	62,278	62,276	— 2	1 in 31,139
2.......	154–800	227,967	+797	228,764	228,734	— 30	1 in 7,625
3.......	800–949	49,119	+172	49,291	49,190	—101	1 in 488

A combination of the figures in the foregoing table indicates that in a total distance of 340,200 feet, or about 65 miles, there was an apparent error of 133 feet, or 1 in about 2,565. It would not, of course, be proper to claim any such accuracy for the stadia work, and in fact the figures themselves do not justify such a claim, as the range between them is too great to admit of any general deduction from the three combined results. For the purposes of this discussion it would have been better if the line could have been divided into more numerous sections and if more than one comparison for the determination of the stadia factor could have been made.

A second condition is represented by the supposition that the rods were originally accurately subdivided so as to read to feet, tenths, and hundredths and that the stadia wires were at a fixed interval of 1 to 100. A correction inherent to this condition, from the theory of stadia measurement, is that of $f + c$, f corresponding to the distance from the plane of the cross wires to the objective, and c being the distance from the center of the instrument to the objective. In order to obtain a correct distance the measurement should, then, be from a point which is $f + c$, or, in the instrument used, 0.95 feet, ahead of the center of the transit. In other words, this amount should be added to the distance obtained at each transit station.

Table showing discrepancies between stadia distances affected by "$f+c$" correction and computed distances.

Section.	Stations.	Stadia distance reduced to mean sea level.	Correction for $f+c$.	Corrected distance.	Computed distance.	Discrepancy add to stadia distance.	Discrepancy.
		Feet.	*Feet.*	*Feet.*	*Feet.*	*Feet.*	
1...	0- 154	62,061	+146	62,207	62,276	+ 69	1 in 903
2...	154- 800	227,967	+614	228,581	228,734	+153	1 in 1,495
3...	800- 949	49,119	+142	49,261	49,190	− 71	1 in 693
4...	949-1,046	33,058	+ 92	33,150	33,174	+ 24	1 in 1,381

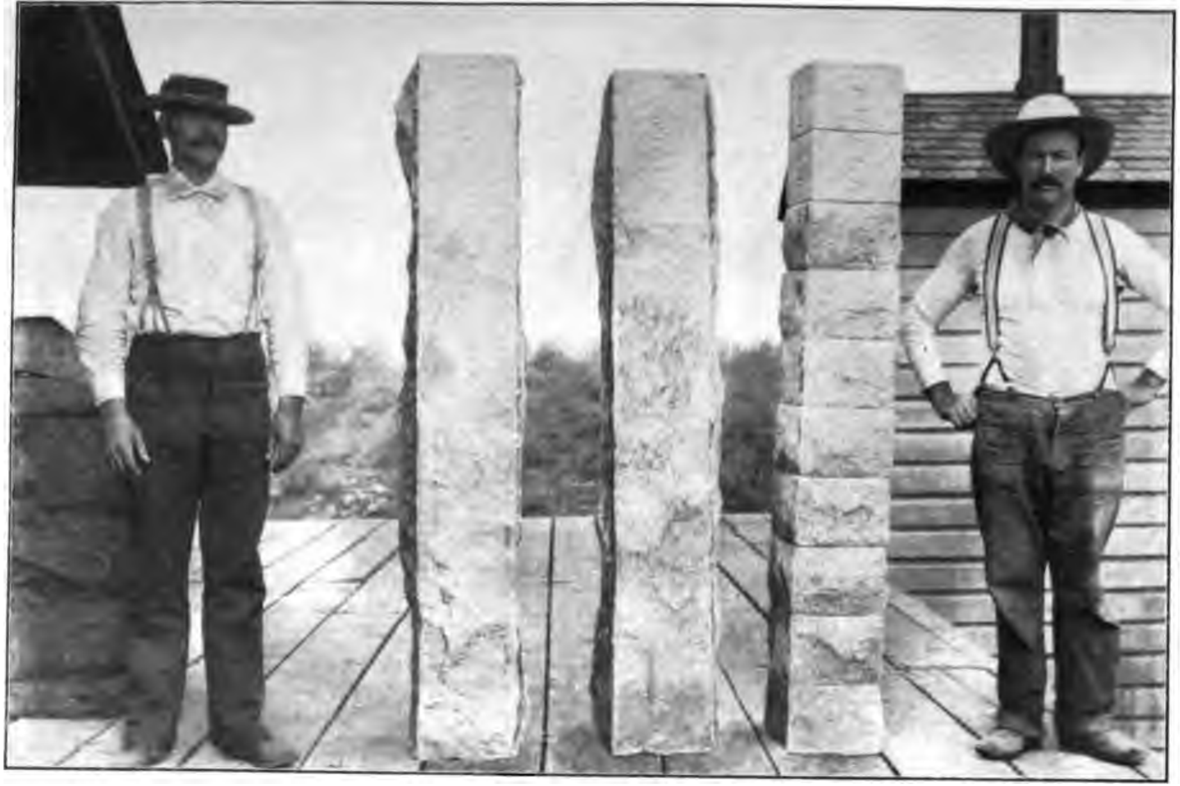
The mean discrepancy for the whole distance is 175 feet, or 1 in 2,133. This, it will be observed, approximates that obtained after application of the stadia-factor correction.

The results from the application of the $f+c$ correction serve to indicate that the rod was graduated approximately correctly, as intended, and the stadia wires were fixed so as to read distances on the rod approximately in the proportion of 1 to 100. As the stadia-factor correction was systematic, the results obtained for distances along the boundary line by a direct adjustment of the original stadia distances to fit the triangulation exactly correspond to those which would have been obtained if the stadia-factor correction had been first applied and the remaining discrepancy afterwards adjusted to the triangulation.

The only check obtained with reference to vertical distances or measurements of height is that furnished by the portion of the line between the Northern Pacific and Great Northern railroads. Along the former road is a line of precise levels run by the United States Geological Survey from a mean sea-level connection at Tacoma, Washington. The stadia line was connected with a bench mark of the precise levels, and this bench mark is the datum upon which the elevation of the stadia line is based. The profile of the Great Northern Railway adjusted to the United States Geological Survey precise levels furnished an elevation at Leonia to which the stadia line was joined. The resulting discrepancy was 73 feet, which is greater than might reasonably be expected, but it is possible that some of the error may be in the railroad profile.

The details relating to the profile of the boundary line between these two railroads are as follows: Sum of horizontal components, 201,188 feet; sum of vertical components, 42,700 feet; discrepancy in closure, 73 feet; discrepancy referred to horizontal components equals 1 in 2,756; discrepancy referred to vertical components equals 1 in 585.

Extensive and careful experiments with the stadia were made by the



GRANITE BOUNDARY-LINE MONUMENTS.

The monument on the right was cut in ten sections for transportation on pack animals.

Boundary Commission engaged in the survey and re-marking of the boundary between the United States and Mexico west of the Rio Grande; and as the conclusions reached so nearly correspond to those arrived at in connection with the Idaho-Montana line, the following quotations are made:

> The method by stadia is cheap and rapid; requires less cutting than that by chain; is carried on under the eye of an instrument man, presumably of a high order of intelligence; gives heights and angles, and enables objects to be located from the line which is being measured; is ordinarily more accurate than the chain, and can be successfully used where the chain can not be, experience on this survey having shown that the stadia lines over mountains, hills, and canyons were more accurate than those on level plains and wide valleys. * * *
>
> In view of this proof of the inevitable change in the value of the interval, the common practice of painting a rod to correspond with the stadia interval of a certain hour and day and then continuing the use of such rod unchecked and unchanged during the widely different seasons of this country oftentimes—in fact, for many years at a time—is seen to be inviting the large systematic error which almost without exception characterizes such work. If this evidence be taken to prove the fact that even so-called fixed stadia wires actually change their relative positions, or, what amounts to the same thing, appear to change on account of the influence of differential refraction at different seasons, then the present method of painting the rod to correspond with the determined interval is objectionable because of the cost of regraduating and repainting the rod to correspond to such change in interval. A method entirely free from this objection of cost, and one which the writer has found to stand every test during several years of field use, is that which uses rods divided into true units of feet, yards, or meters and employs an interval factor in the computation of distances. With this system a change in the interval simply means the loss of an hour's time in the preparation of a new table for reduced or true distances corresponding to any rod reading.

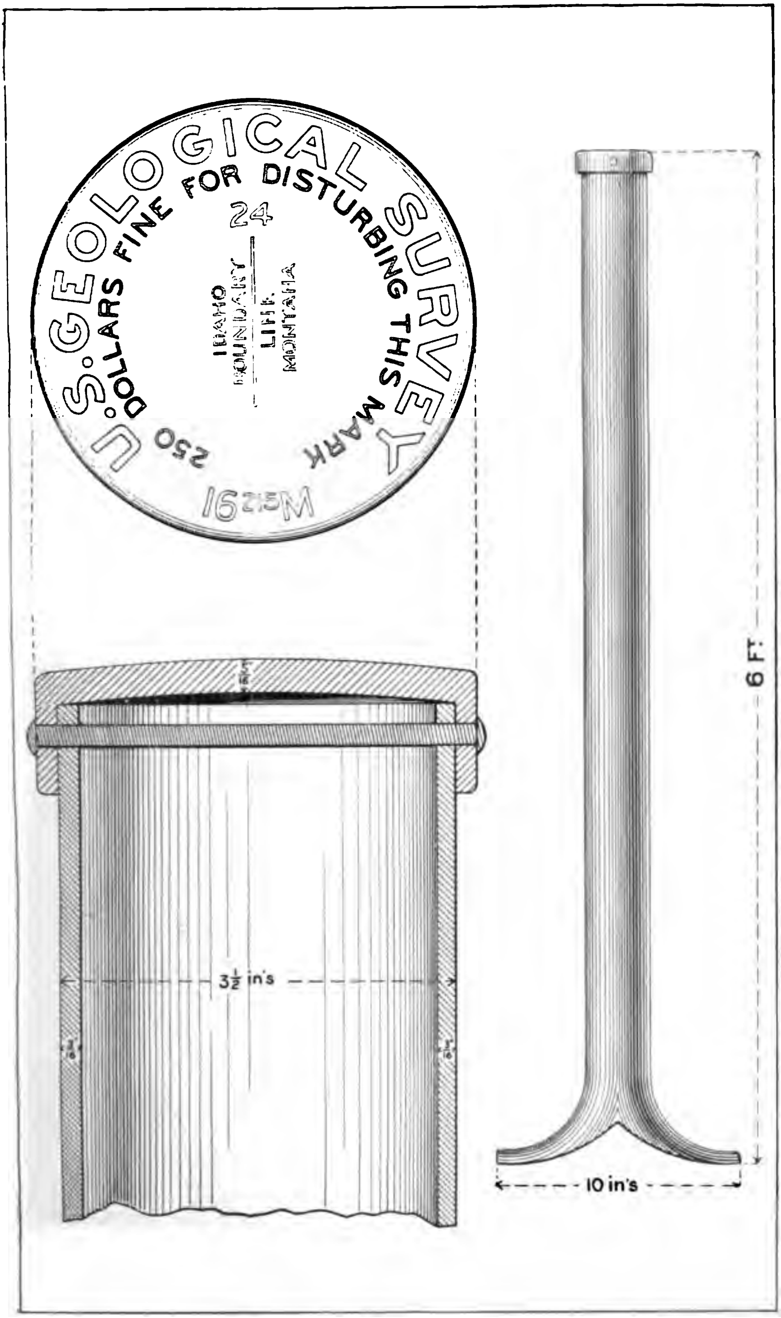
MONUMENTS.

The monuments used along the meridional portion of the line are of two kinds—stone and iron. The stone monuments are of granite, 6 feet in length and 10 inches square, undressed except for spaces sufficient to permit cutting the words "Idaho" and "Montana," on opposite sides. These monuments are placed in the more prominent localities, and are monolithic in all cases where it was possible to transport them in one mass to the proper position; otherwise they were cut into ten sections, so that they could be carried on pack mules, and were bolted and cemented together when established in place. The monuments at the international boundary and at the summit of the Bitterroot Mountains, these being the terminal points of the meridional portion of the line, are of stone made from sections, as described, and monoliths are placed near the points at which the boundary line crosses the Northern Pacific and Great Northern railways. (See Pl. VII.) The iron monuments are hollow posts of wrought iron, 6 feet in length and about 4 inches in outer diameter, covered with a coat of asphaltum tar. At the bottom they are flared to a width of 12 inches, to insure more secure planting. These posts are set to a depth of 3 feet below the surface of the ground, 3 feet remaining above ground, and a conical mound of earth being raised around them to a height of 2 feet. On the tops of the posts are riveted bronze caps, on which is cut appropriate lettering, and the number of the monument and the distance (in miles) from the international boundary are stamped in large figures. (See Pl. VIII.) In addition to the four stone monuments referred to, eighty-nine iron monuments were placed. The sites for the monuments were chosen with reference to the topographic features of the country, instead of being placed at even miles, as has usually been the custom on boundary lines, but there are few intervals greater than a mile between the monuments, the average interval being about three-fourths of a mile. They were placed generally on summits, or near streams, roads, or trails, and so as to be intervisible when possible. Between the monuments the line is thoroughly cut out, and adjacent trees are blazed, so that it can be readily recognized in any locality.

The stone monuments were quarried at Medical Lake, Washington, and cost $14.50 apiece delivered at the railroad station nearest the point at which they were established. The iron posts were made in St. Louis, and cost $2.08½ delivered to the United States quartermaster at St. Louis.

Previous to the work herein referred to no attempt had ever been made to locate and mark the Idaho-Montana boundary line, but the engineers of the Northern Pacific and Great Northern railways had estimated the points at which it crossed their tracks and established marks according to this estimation. The accepted crossing on the Northern Pacific was found to be about one-fourth of a mile west of the true line and that of the Great Northern about 1 mile east of the true line along the railway track, but only about a half mile east thereof in direct longitude. Kootenai County, Idaho, spent a considerable sum of money in grading a road up the mountain from Leonia toward Sylvanite, which, when the boundary line was located soon after, was found to be in Flathead County, Montana.

Each monument is witnessed by pits and mounds wherever practicable, the pits being dug across the line distant 4 feet north and south of the post, and the mounds being 4 feet east and west thereof. The dimensions of the pits are 3 by 2 by 1½ feet, and the mounds were constructed from the excavated material. The monuments are further witnessed, usually by four blazed bearing trees, one in each quadrant. The two trees in Idaho at post 48, for instance, were deeply engraved "Idaho P. 48 B. T.," and the two trees in Montana were marked in a corresponding manner. (See Pl. IX.) Under each monument was placed about a quart of charcoal. In the notes the distance and bearing to the witness trees were marked and the trees described.



DESIGN FOR IRON POST.

Complete copies of these notes can be found in the offices of the Geological Survey and the General Land Office in Washington and of the surveyors-general in Idaho and Montana.

A general description of the monuments is given below. The figures followed by the letter "M" indicate the distance in miles and hundredths of a mile from the initial monument.

Initial monument: Stone masonry monument, 6 feet long, 10 by 10 inches square, consisting of ten sections cemented and bolted together. An aluminum bench-mark tablet is set with cement in the top of the monument stamped "1899, Elev. 4500." The monument stands amid tall, dense timber on west slope of ridge, about a half mile east of creek.

1. Iron post, stamped "0.40 M.," on west slope of ridge, amid tall, dense timber.

2. Iron post, stamped "1.15 M.," on west slope of ridge, amid tall, dense timber.

3. Iron post, stamped "1.82 M.," on west slope of ridge, amid tall, dense timber.

4. Iron post, stamped "2.85 M.," on top of a ridge making out from the west slope of the main ridge, amid tall, dense timber.

5. Iron post, stamped "3.68 M.," between two branches, 30 feet apart, of a small creek flowing west, about a half mile east of the junction of said creek with a creek flowing north, amid dense timber.

6. Iron post, stamped "4.66 M.," 30 feet south of a creek flowing west and about one-fourth mile east of the junction of said creek with a creek flowing north, amid dense timber.

7. Iron post, stamped "5.415 M.," amid dense timber, 300 feet south of a small creek flowing west, and about one-fourth mile east of creek flowing northwest.

8. Iron post, stamped "6.295 M.," 2.5 miles north of the Buckhorn mine, on bare grassy ridge, 100 feet east of edge of green timber. A lone fir tree stands 200 feet east of the post.

9. Iron post, stamped "6.825 M.," 1¾ miles north of the Buckhorn mine, amid heavy fir timber, on west slope of high timbered ridge.

10. Iron post, stamped "7.53 M.," 1 mile north of the Buckhorn mine, on top of ridge, amid fir timber.

11. Iron post, stamped "8.21 M.," in north end of basin, at south edge of green timber, 100 feet east of foot of slope.

12. Iron post, stamped "8.61 M.," on top of bare ridge, a half mile east of the Buckhorn cabins.

13. Iron post, stamped "9.03 M." (post should have been stamped "9.00 M."), on top of bare rocky ridge, a half mile south of the Buckhorn mines, about 600 feet southeast from the highest point on the ridge.

14. Iron post, stamped "9.505 M." (post should have been stamped

"9.47 M."), on south edge, about halfway between the top of ridge and creek, on a small secondary ridge bearing S. 60° W., amid scattering fir timber, just north of an open space.

15. Iron post, stamped "10.16 M.," amid dense timber, on south bank of a creek flowing west, about 330 feet north of another creek flowing in same direction.

16. Iron post, stamped "11.005 M.," amid heavy timber, on top of a ridge on main west slope.

17. Iron post, stamped "11.49 M.," amid dense timber, on top of high ridge bearing west.

18. Iron post, stamped "12.12 M.," on top of a heavily timbered ridge south of creek in deep ravine, and a half mile east of creek flowing northwest.

19. Iron post, stamped "12.915 M.," 20 feet north of creek flowing northwest, about 1 mile north of Windy Pass trail.

20. Iron post, stamped "13.70 M.," on top of timbered ridge, 30 feet south of Windy Pass trail, three-fourths of a mile north of Skin Creek.

21. Iron post, stamped "14.40 M.," on top of north bank, 100 feet distant from Skin Creek, amid heavy timber.

22. Iron post, stamped "14.86 M.," 1¼ miles north of summit of Yak Mountain, a half mile south of Skin Creek, on top of heavily timbered ridge bearing northeast.

23. Iron post, stamped "15.62 M.," a half mile north of summit of Yak Mountain, on rocky ridge one-fifth of a mile northeast from Buckhorn triangulation station, amid scattering fir timber.

24. Iron post, stamped "16.215 M.," 10½ miles north of Leonia, on summit of Yak Mountain, 30 feet east of the highest point of the right-hand peak of three which are on the northwest end of the range as seen from the vicinity of Leonia. A signal tree stands 32 feet south and 2 feet east of the post. This post is visible from the whole surrounding country.

25. Iron post, stamped "16.81 M.," 9¾ miles north of Leonia, amid heavy timber, on slope of Yak Mountain, 0.6 mile south of the summit.

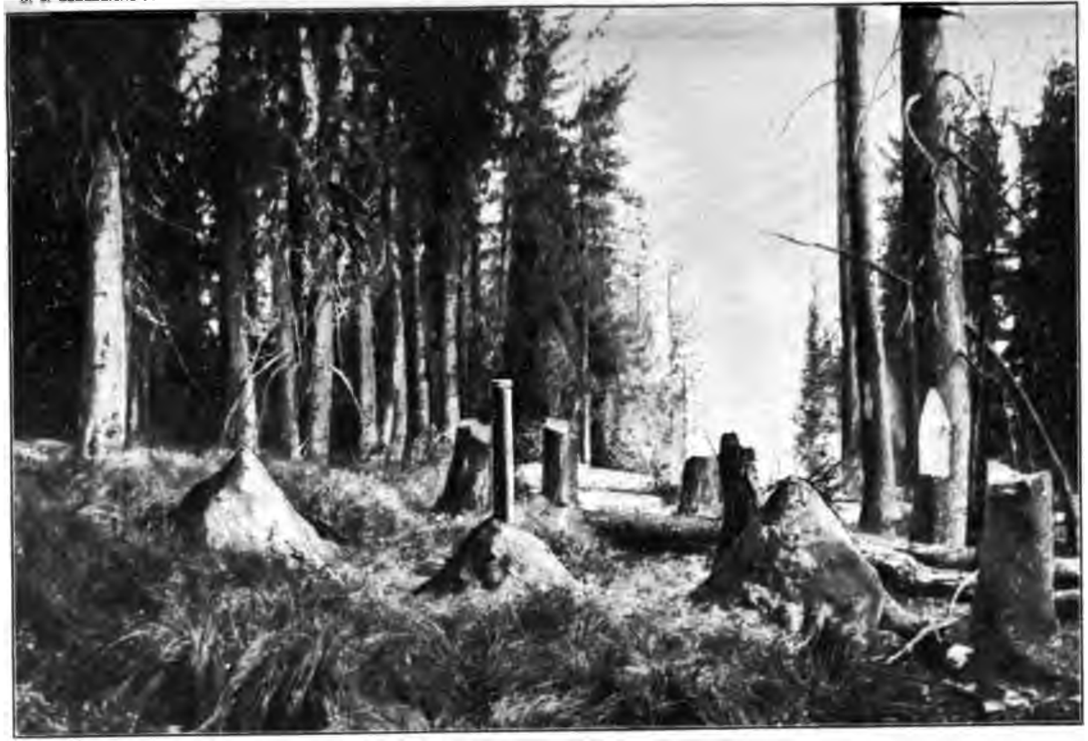
26. Iron post, stamped "17.50 M.," 9.1 miles north of Leonia, on top of a heavily timbered east-west ridge, on slope of Yak Mountain.

27. Iron post, stamped "18.05 M.," 8½ miles north of Leonia, one-fourth of a mile north of Curly Creek, on the south edge of a bench, at southern edge of thick growth of small pines.

28. Iron post, stamped "19.06 M.," 7½ miles north of Leonia, 1 mile north of Kinzie's ranch, at foot of mountain 2 miles west of Cross triangulation station, one-fifth of a mile north of Kingsley Creek, amid heavy timber.

29. Iron post, stamped "19.79 M.," 6¾ miles north of Leonia, amid heavy timber, 300 feet north of edge of meadow at Kinzie's ranch and 10 feet north of trail leading northwest from that ranch.

30. Iron post, stamped "20.40 M.," 6.1 miles north of Leonia, one-



POST 48, AT SUMMIT OF TIMBERED RIDGE.

fourth of a mile north of Newton's house, at north end of meadow, where a large spring comes out, 10 feet south of wagon road, 200 feet west of foot of hill.

31. Iron post, stamped "21.22 M.," 5.4 miles north of Leonia, a half mile south of Newton's house, at southeast corner of large meadow, at west edge of timber, and 75 feet east of Curly Creek.

32. Iron post, stamped "21.73 M.," 4.9 miles north of Leonia, about 1 mile north of Lang's ranch, 500 feet south of Curly Creek, and 10 feet north of wagon road.

33. Iron post, stamped "22.23 M.," 4.4 miles north of Leonia, 0.3 mile north of where the line crosses a valley just west of Lang's ranch, amid heavy timber on side hill, about midway between valley on the west and top of hill on the east.

34. Iron post, stamped "23.12 M.," 3.5 miles north of Leonia, 0.2 mile south of where the boundary line crosses Curly Creek, amid heavy timber on west slope, about 600 feet east of Curly Creek.

35. Iron post, stamped "24.10 M.," 2.5 miles north of Leonia, on top of a ridge bearing N. 30° E., where the line ascends from Curly Creek bottom, amid dense timber.

36. Iron post, stamped "24.965 M.," 1.7 miles north of Leonia, on high ground, 0.2 mile north of Lime Creek.

37. Iron post, stamped "25.79 M.," 0.9 mile north of Leonia, 10 feet south of wagon road, amid heavy timber.

38. Iron post, stamped "26.14 M.," a half mile north of Leonia, on top of east bank of Kootenai River, 180 feet above surface of water.

39. Stone monument, 6 feet by 10 inches by 10 inches, with an aluminum bench-mark tablet, stamped "26.64 M.," cemented in its top, located at Leonia, near foot of hill west of Great Northern Railway monument; bears S. 5° W., 584 feet distant from depot chimney. (See Pl. XI, *A*.)

40. Iron post, stamped "27.45 M.," 0.9 mile south of Leonia, at north edge of large timber and at south edge of brush, on steep east slope.

41. Iron post, stamped "28.215 M.," 1.6 miles south of Leonia, on flat amid heavy timber and dense underbrush, a half mile southwest of the Keeler cabins.

42. Iron post, stamped "29.115 M.," 2.5 miles south of Leonia, 0.3 mile south of a creek flowing east and 0.4 mile north of a creek flowing southeast into Star Creek, on top of a ridge bearing S. 45° E., amid thick small pines. (See Pl. X.)

43. Iron post, stamped "30.03 M.," 3.4 miles south of Leonia, on top of south bank of deep ravine, one-fifth of a mile west of where it joins a creek flowing southeast; amid heavy timber.

44. Iron post, stamped "31.03 M.," 4.4 miles south of Leonia, 1 mile north of Star Creek, amid heavy timber, on small ridge 200 feet north of small stream flowing east.

45. Iron post, stamped "32.17 M.," 5.5 miles south of Leonia, 200 feet south of Star Creek, a half mile below the mouth of a creek which empties into Star Creek from the southwest, about 600 feet above the mouth of a ravine which enters Star Creek from the southeast, and about 50 feet higher than the bed of creek; amid large timber.

46. Iron post, stamped "33.01 M.," 6.4 miles south of Leonia, 0.9 mile south of Star Creek, amid large scattering pine trees and dense small pines, on top of an east-west ridge about midway between Star Creek on the west and the top of high ridge on the east.

47. Iron post, stamped "33.74 M.," 7.2 miles south of Leonia, on steep slope draining west into Star Creek, 150 feet north of a small stream bearing N. 45° E., amid dead and scattering live timber.

48. Iron post, stamped "34.755 M.," 8.2 miles south of Leonia, on top of high timbered ridge, bearing SW.–NE., which forms the divide between Star and Callahan creeks. A line 20 feet in width was cut in the timber and can be seen from the summit of Yak Mountain and intermediate points to the north and from the summit of the Cabinet Mountains and intermediate points to the south. (See Pl. IX.)

49. Iron post, stamped "35.37 M.," 3.4 miles north of west fork of Callahan Creek, on top of a heavily timbered ridge bearing east–west, about a half mile east of the junction of said ridge with the main ridge, the point of junction being the highest point on the main ridge.

50. Iron post, stamped "36.31 M.," 2.5 miles north of the west fork of Callahan Creek, on top of a timbered ridge bearing NW.–SE., about 1,000 feet northwest of a trapper's cabin, in saddle on said ridge.

51. Iron post, stamped "36.86 M.," 2 miles north of the west fork of Callahan Creek, on west point of ridge, amid dead and scattering live trees about one-fourth of a mile west of top of high ridge bearing east.

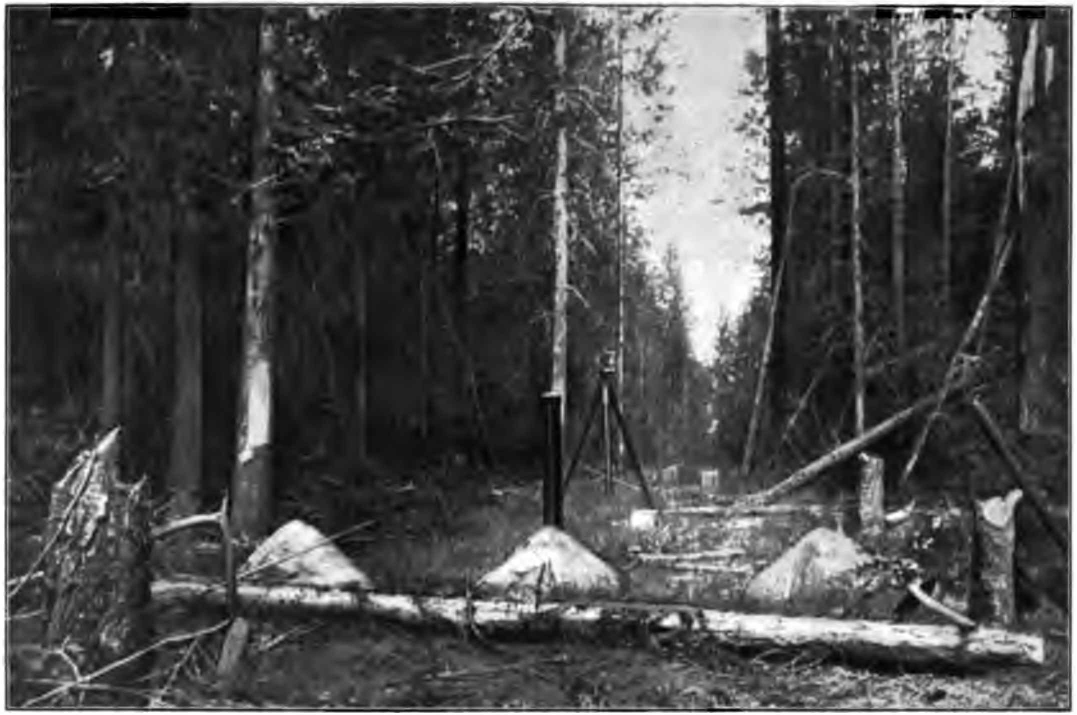
52. Iron post, stamped "37.52 M.," 1.3 miles north of the west fork of Callahan Creek, on top of a bare ridge bearing southeast, about halfway between the top of the ridge on the west and a deep ravine on the east.

53. Iron post, stamped "38.57 M.," 0.25 mile north of the west fork of Callahan Creek, one-fourth of a mile west of a deep ravine from the north, on point of ridge bearing southeast, amid scattering trees and brush.

54. Iron post, stamped "39.59 M.," on top of high timbered ridge between the west and main forks of Callahan Creek.

55. Iron post, stamped "40.51 M.," in Callahan Creek bottom, 50 feet west of bank of creek and just east of the old Lightning Creek trail, amid large, dense timber.

56. Iron post, stamped "41.51 M.," 1 mile south of Callahan Creek on high, flat ridge bearing nearly east–west, amid tall timber.



POST 42, AND LINE CUT THROUGH TIMBER.

57. Iron post, stamped "42.35 M.," 1.8 miles south of Callahan Creek on top of timbered ridge bearing NE.–SW.

58. Iron post, stamped "43.50 M.," on top of high-timbered ridge which forms the divide between Callahan and Keeler creeks, near the head of the east fork of Callahan Creek.

59. Iron post, stamped "44.16 M.," on point of ridge between and about 300 feet west from the junction of two gulches which form the north branch of Keeler Creek, amid dense timber.

60. Iron post, stamped "44.72 M.," on top of heavily-timbered ridge bearing S. 60° E., between two forks of Keeler Creek.

61. Iron post, stamped "45.10 M.," in deep canyon, 50 feet south of the west fork of Keeler Creek, amid heavy timber.

62. Iron post, stamped "46.01 M.," on top of high east–west timbered ridge between two west forks of Keeler Creek.

63. Iron post, stamped "46.68 M.," amid heavy timber on top of bench 600 feet north and about 100 feet above the west fork of Keeler Creek, about a half mile west of the junction of the west fork with the main branch of that creek.

64. Iron post, stamped "47.78 M.," 150 feet north and 40 feet above Keeler Creek, which bears N. 30° E., nearly opposite the mouth of a canyon in the cliffs on east side of creek, at the east edge of timber.

65. Iron post, stamped "48.67 M.," 2.35 miles north of the east fork of Lightning Creek, on top of the east–west rocky ridge which forms the divide between Keeler and Lightning creeks, about 400 feet west of a saddle and 100 feet east of a hump on the ridge.

66. Iron post, stamped "49.54 M.," 1.5 miles north of the east fork of Lightning Creek, on top of a grassy east–west ridge, about 600 feet east of a peak where the ridge joins a north–south ridge, amid scattering fir trees.

67. Iron post, stamped "50.09 M.," 0.9 mile north of the east fork of Lightning Creek, at the top of slope, in top of rocks on southeast end of a ridge.

68. Iron post, stamped "50.99 M.," on bench 435 feet north of the east fork of Lightning Creek and about 200 feet higher than the creek, amid heavy timber nearly opposite the mouth of a ravine on south side of creek.

69. Iron post, stamped "51.85 M.," on top of high rocky ridge between two east forks of Lightning Creek, in top of rock ledge.

70. Iron post, stamped "52.725 M.," 10 feet south of the east fork of Lightning Creek, amid large timber.

71. Iron post, stamped "53.24 M.," a half mile south of the east fork of Lightning Creek, 1 mile north of summit of Cabinet Mountains, on top of ridge bearing N. 15° E., amid scattering pine and fir trees.

72. Iron post, stamped "54.22 M.," on summit of Cabinet Mountains, between the head waters of East Lightning and West Blue

creeks, about 1,000 feet northeast from a peak, at west edge of small fir trees and grass, where rocks begin in ascending the peak, about one-third mile west of a saddle on summit ridge. This point is visible from post 24 on the summit of the Yak Mountains and from all prominent intermediate points, also from post 92, on the summit of the Bitterroot Mountains and from intermediate points.

73. Iron post, stamped "54.905 M.," on top of narrow rocky ridge bearing S. 36° E., 0.7 mile south of the summit of the Cabinet Mountains; 0.4 mile south of basin at head of West Blue Creek, amid scattering fir and pine trees.

74. Iron post, stamped "55.58 M.," on top of rock ledge 1.4 miles south of the summit of the Cabinet Mountains, 0.7 mile north of West Blue Creek, on east slope of rocky ridge, 0.6 mile east of the triangulation station Blacktop, and 900 feet south of a small stream flowing east.

75. Iron post, stamped "56.285 M.," 2.1 miles south of the summit of the Cabinet Mountains, 30 feet east of West Blue Creek, 120 feet south of where line crosses creek under high cliffs on east side of creek, 8 feet south of a 36-inch hemlock stump and amid heavy timber.

76. Iron post, stamped "57.14 M.," 2.9 miles south of the summit of the Cabinet Mountains, on west side of West Blue Creek and 173 feet south of where line crosses it, opposite almost perpendicular cliffs on the east side of creek, about 0.25 mile above the mouth of a canyon from the northeast, amid large timber just west of an old trail.

77. Iron post, stamped "57.975 M.," 3.7 miles south of the summit of the Cabinet Mountains, on a small bench on steep rocky slope, one-fourth mile east of West Blue Creek.

78. Iron post, stamped "58.93 M.," 4.7 miles south of the summit of the Cabinet Mountains, on top of a narrow ridge, 200 feet above West Blue Creek and about opposite the south end of a long ridge on the west side of the creek, amid scattering pine trees.

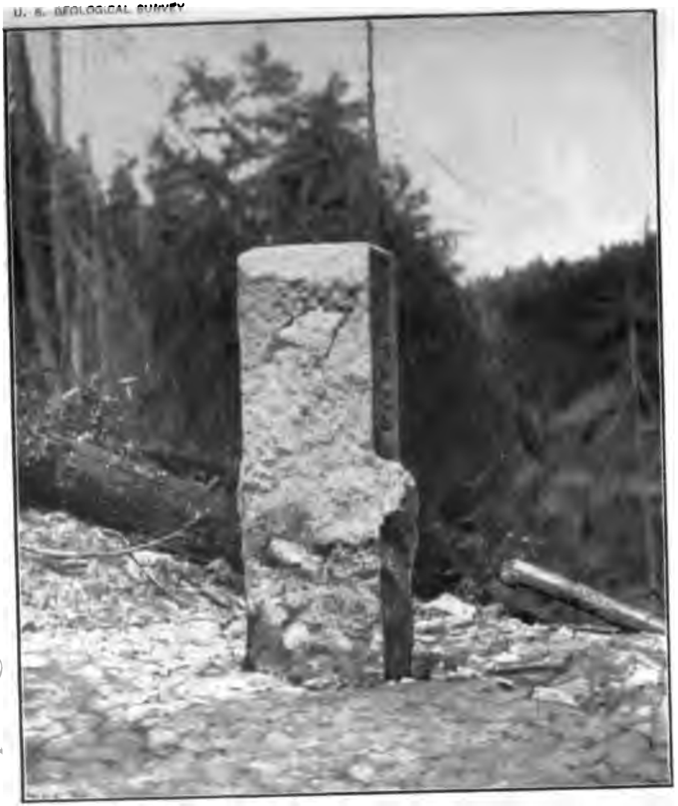
79. Iron post, stamped "59.975 M.," 3 miles north of Clark Fork of Pend Oreille, on top of north bank of West Blue Creek at south side of large flat; in open ground.

80. Iron post, stamped "60.79 M.," 2.1 miles north of Clark Fork, on flat ground, amid heavy, dense timber, about 600 feet west of edge of bench, where the surface descends to West Blue Creek. An old trail crosses the line 150 feet south of the post.

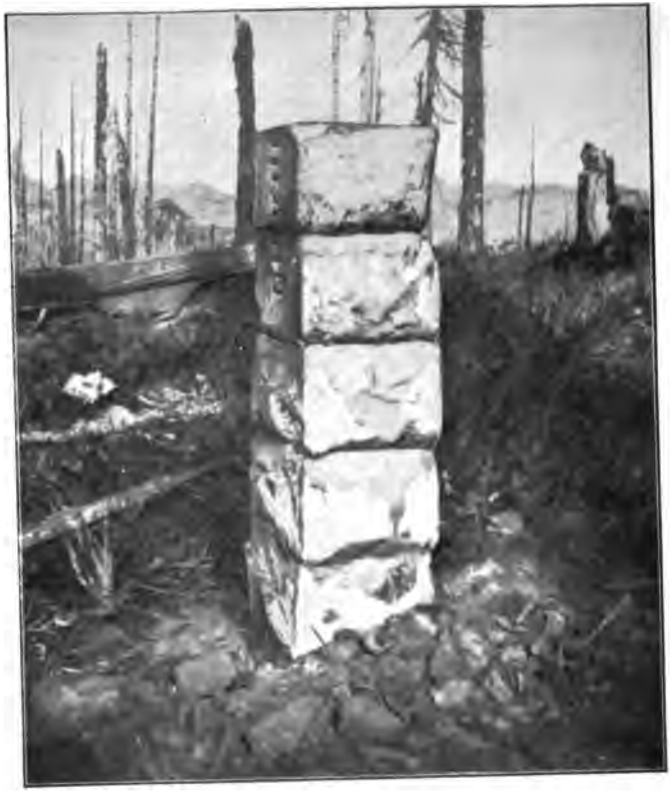
81. Iron post, stamped "61.605 M.," 1.3 miles north of Clark Fork, on top of flat ridge, amid heavy timber, 30 feet southeast of a pond 100 feet in diameter.

82. Iron post, stamped "62.35 M.," 0.5 mile north of Clark Fork, on top of flat east-west ridge, amid heavy timber.

83. Stone monument 6 feet long, 10 inches by 10 inches square, with an aluminum bench-mark tablet stamped "63.03 M." cemented



A. GRANITE MONUMENT ON BOUNDARY LINE NEAR LÉONIA, IDAHO.



B. SECTIONAL MONUMENT AT SUMMIT OF BITTERROOT MOUNTAINS.

in its top, located 7 feet north of the Northern Pacific Railway, 1 mile eastward from Cabinet, Idaho, 450 feet eastward from sign "1 mile to Cabinet," 150 feet eastward from a cut at sharp curve in railroad track.

84. Iron post, stamped "63.98 M.," 1 mile south of the Northern Pacific Railway, 0.2 mile northward from Baker's house, amid heavy timber on south bank of small stream flowing N. 75° W.

85. Iron post, stamped "64.95 M.," 1.9 miles south of the Northern Pacific Railway at the foot of mountain, 100 feet west of the mouth of a small stream in deep ravine; amid heavy timber.

86. Iron post, stamped "65.70 M.," 2.7 miles south of the Northern Pacific Railway, under west brow of a long, narrow ridge, about 300 feet south from where the ridge begins steep descent; amid dense timber.

87. Iron post, stamped "66.50 M.," 3.5 miles south of the Northern Pacific Railway, on top of high east-west ridge, about 300 feet east of its junction, with a north-south ridge; amid scattering large timber.

88. Iron post, stamped "67.46 M.," on top of high east-west timbered ridge, 1 mile north of the west fork of Elk Creek, about one-fourth mile east of where the ridge joins north and south ridge.

89. Iron post, stamped "68.475 M." (post should have been stamped "68.44 M."), in heavily timbered bottom, 60 feet north of the dry bed of the west fork of Elk Creek, about 1 mile west of the mouth of a creek from the southwest.

90. Iron post, stamped "69.08 M.," on top of narrow east-west ridge between the west fork of Elk Creek and a small stream from the southwest, amid timber.

91. Iron post, stamped "69.76 M.," on top of nearly bare ridge between two ravines bearing northeast.

92. Stone masonry monument, 6 feet long, 10 inches by 10 inches square, consisting of ten sections cemented and bolted together. An aluminum bench mark stamped "92–70.717 M., 4,850 feet" is cemented into the top of the monument. The monument stands on the top of a bare grassy ridge, amid scattering dead trees, at the junction of a ridge from the west with said ridge. The ridge at this point bears NW.–SE. and forms the summit of the Bitterroot Mountains. (See Pl. XI, *B*.)

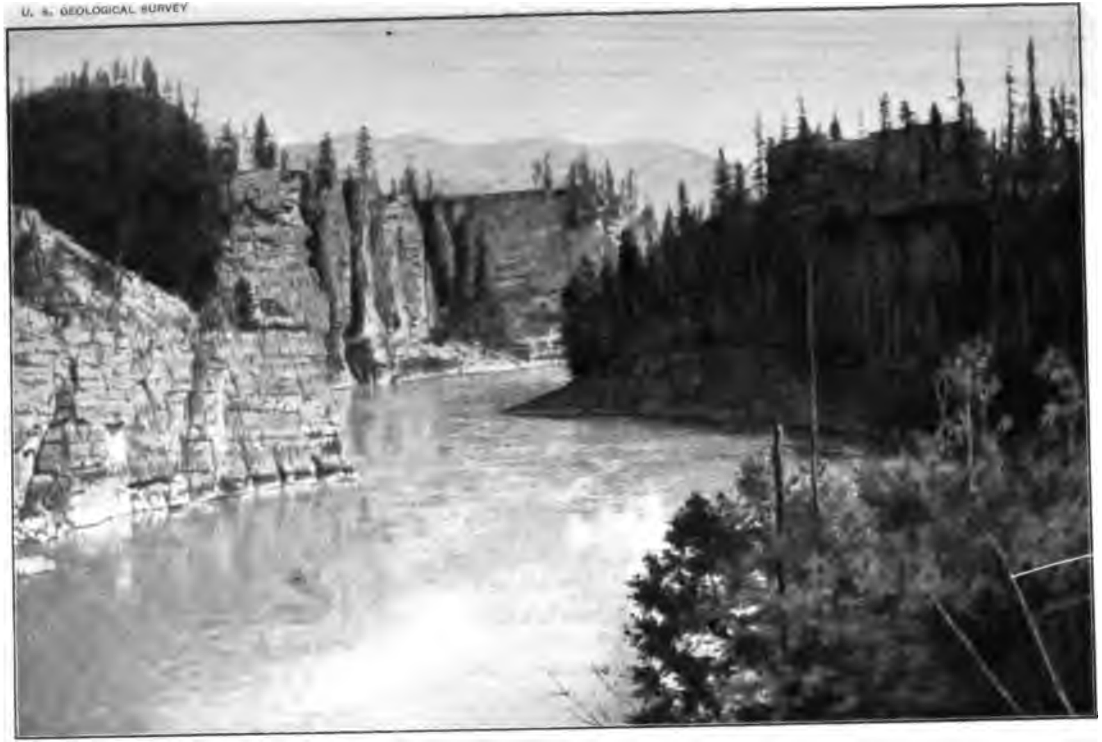
It will be recalled that it has been previously mentioned that an error was made in the field computation, the result of which was to locate the starting point of the random line 177 feet east of the true point. The transitman did not know of this error when he surveyed the random line, but as a result of a personal equation introduced into his work his line varied from a true line by a constant swing toward the west, so that when he reached the international boundary the point on the random line was 43 feet east of the true point. Thus, in about 71 miles the transitman ran a line which at its terminal point was 134 feet "out" in azimuth. With this explanation the following table is self-explanatory:

Table showing number and kind of monuments, distances, elevations, magnetic declinations and time of magnetic observations along the boundary.

Number of monument.	Distance from international boundary.	Elevation at monument.	Distance west from random line.	Kind of monument.	Magnetic declination (east).	Time of magnetic observation.
	Miles.	*Feet.*	*Feet.*		° ′	
0	0.00	4,505	43	Stone		
1	0.40	4,691	49	Iron post.	23 10	9 a. m., Oct. 31, 1898.
2	1.15	5,008	59.5	do	23 02	1 p. m., Oct. 30, 1898.
3	1.82	5,186	65	do	23 15	8 a. m., Oct. 30, 1898.
4	2.85	5,496	74	do	23 18	1.30 p. m., Oct. 28, 1898.
5	3.68	5,223	79.8	do	23 08	3 p. m., Oct. 27, 1898.
6	4.66	5,167	82	do	23 00	3 p. m., Oct. 26, 1898.
7	5.415	5,477	82.5	do	23 08	8.30 a. m., Oct. 26, 1898.
8	6.295	6,124	83.5	do	23 08	11 a. m., Oct. 25, 1898.
9	6.825	5,954	84	do	23 02	3 p. m., Oct. 22, 1898.
10	7.53	6,069	85	do	23 02	8 a. m., Oct. 22, 1898.
11	8.21	5,712	86	do	23 03	1 p. m., Oct. 21, 1898.
12	8.61	6,116	87	do		
13	*a* 9.00	6,161	87	do	22 54	10 a. m., Oct. 21, 1898.
14	*b* 9.47	6,612	88	do	23 05	1 p. m., Oct. 20, 1898.
15	10.16	4,595	89	do	23 02	4 p. m., Oct. 19, 1898.
16	11.005	5,514	90	do	22 55	2 p. m., Oct. 18, 1898.
17	11.49	5,407	91	do	22 52	3.45 p. m., Oct. 17, 1898.
18	12.12	5,200	91.5	do	23 12	9 a.m., Oct. 17, 1898.
19	12.915	4,375	93	do	23 05	1 p. m., Oct. 15, 1898.
20	13.70	5,700	94	do	22 45	2 p. m., Oct. 10, 1898.
21	14.40	4,374	95	do	23 01	8 a. m., Oct. 10, 1898.
22	14.86	5,448	95	do	22 57	8.30 a. m., Oct. 8, 1898.
23	15.62	6,290	96	do	22 43	Noon, Oct. 7, 1898.
24	16.215	6,627	96	do		
25	16.81	5,406	97	do	23 08	5 p. m., Oct. 3, 1898.
26	17.50	4,966	98	do	23 25	1 p. m., Oct. 3, 1898.
27	18.05	3,817	98	do	22 30	5 p. m., Oct. 2, 1898.
28	19.06	2,864	99	do	23 00	10.30 a. m., Oct. 2, 1898.
29	19.79	2,523	100	do	23 08	1 p. m., Oct. 1, 1898.
30	20.40	2,504	100.5	do	23 05	5 a. m., Oct. 1, 1898.
31	21.22	2,490	101	do	23 02	9 a. m., Sept. 30, 1898.
32	21.73	2,520	102	do	22 59	4.30 p. m., Sept. 28, 1898.
33	22.23	2.694	102	do	22 50	11 a. m., Sept. 28, 1898.
34	23.12	2,541	103	do	22 56	1.30 p. m., Sept. 26, 1898.
35	24.10	2,418	104	do	23 00	8.30 a. m., Sept. 26, 1898.
36	24.965	2,425	105	do	23 50	1.30 p. m., Sept. 24, 1898.
37	25.79	2,199	106	do	22 08	4.30 p. m., Sept. 23, 1898.
38	26.14	1,978	107	do		
39	26.64	1,833	107	Stone	22 45	1 p. m., Sept. 23, 1898.
40	27.45	2,678	107	Iron post.	22 48	8 a. m., Sept. 23, 1898.
41	28.215	3,021	108	do	22 39	1.30 p. m., Sept. 20, 1898.
42	29.115	3,546	109	do	22 35	2.30 p. m., Sept. 19, 1898.

a Stamped 9.03.

b Stamped 9.505.



CLARK FORK OF COLUMBIA RIVER JUST WEST OF BOUNDARY LINE.

Table showing number and kind of monuments, etc.—Continued.

Number of monument.	Distance from international boundary.	Elevation at monument.	Distance west from random line.	Kind of monument.	Magnetic declination (east).		Time of magnetic observation.
	Miles.	*Feet.*	*Feet.*		°	′	
43.	30.06	3,533	110	Iron post.	22	33	5 p.m., Sept. 18, 1898.
44.	31.06	3,357	112	do	22	45	1 p.m., Sept. 16, 1898.
45.	32.17	3,162	114	do			
46.	33.01	4,410	115	do	22	27	1 p.m., Sept. 14, 1898.
47.	33.74	4,392	116	do	22	40	4.30 p.m., Sept. 12, 1898.
48.	34.755	6,127	118	do	22	38	8 a.m., Sept. 12, 1898.
49.	35.37	5,993	119	do	22	25	11 a.m., Sept. 10, 1898.
50.	36.31	5,535	120	do	22	15	2 p.m., Sept. 9, 1898.
51.	36.86	5,572	121	do	22	43	9 a.m., Sept. 9, 1898.
52.	37.52	4,740	122	do	21	26	12.30 p.m., Sept. 7, 1898.
53.	38.57	3,496	109	do			
54.	39.59	4,433	123	do	22	39	12.30 p.m., Sept. 5, 1898.
55.	40.51	3,089	125	do	22	35	2.30 p.m., Sept. 4, 1898.
56.	41.51	4,792	126	do	22	25	4 p.m., Sept. 3, 1898.
57.	42.35	5,446	127	do	22	10	2.30 p.m., Sept. 2, 1898.
58.	43.50	5,870	129	do	22	12	12.30 p.m., Aug. 29, 1898.
59.	44.16	4,887	131	do	22	15	1.30 p.m., Aug. 27, 1898.
60.	44.72	5,107	132	do	22	05	3 p.m., Aug. 26, 1898.
61.	45.10	3,992	133	do	22	23	9 a.m., Aug. 26, 1898.
62.	46.01	5,176	134	do	25	20	2.30 p.m., Aug. 24, 1898.
63.	46.66	3,867	135.5	do	21	45	5 p.m., Aug. 23, 1898.
64.	47.78	4,052	137	do	22	02	4.30 p.m., Aug. 20, 1898.
65.	48.67	5,666	139	do	22	20	2 p.m., Aug. 19, 1898.
66.	49.54	5,781	139	do	22	35	9 a.m., Aug. 19, 1898.
67.	50.09	5,822	139	do	22	28	2.30 p.m., Aug. 13, 1898.
68.	50.99	3,623	141	do	22	20	2.30 p.m., Aug. 12, 1898.
69.	51.85	5,902	141	do	23	10	10 a.m., Aug. 11, 1898.
70.	52.725	4,084	142	do	22	35	10 a.m., Aug. 9, 1898.
71.	53.24	5,366	142	do	22	30	3 p.m., Aug. 8, 1898.
72.	54.22	6,780	163	do	23	14	8 a.m., Aug. 8, 1898.
73.	54.905	6,197	163	do	22	28	7.30 a.m., Aug. 6, 1898.
74.	55.58	5,349	164	do	21	50	1 p.m., Aug. 5, 1898.
75.	56.285	4,139	165	do	23	10	8.45 a.m., Aug. 3, 1898.
76.	57.14	3,774	166	do	22	30	11 a.m., July 30, 1898.
77.	57.975	3,856	166	do	22	52	6.30 p.m., July 28, 1898.
78.	58.93	4,206	167	do	23	05	10 a.m., July 28, 1898.
79.	59.975	2,655	168	do	22	33	1.30 p.m., July 27, 1898.
80.	60.79	2,662	169	do	22	15	Noon, July 26, 1898.
81.	61.605	2,667	169	do	22	27	4 p.m., July 24, 1898.
82.	62.35	2,487	170	do	23	32	1.30 p.m., July 22, 1898.
83.	63.06	2,225	170	Stone	22	22	3 p.m., July 21, 1898.
84.	63.98	2,416	171	Iron post.	22	22	3.45 p.m., July 20, 1898.
85.	64.94	2,501	172	do	23	26	9.30 a.m., July 19, 1898.
86.	65.70	3,990	173	do	22	20	12.30 p.m., July 18, 1898.
87.	66.50	4,953	173	do	22	04	10.30 a.m., July 16, 1898.
88.	67.46	4,793	174	do	22	20	4 p.m., July 14, 1898.
89.	[a] 68.44	2,667	175	do	22	20	11 a.m., July 13, 1898.
90.	69.08	4,341	176	do	22	20	11 a.m., July 12, 1898.
91.	69.76	3,555	176	do			
92.	70.717	4,848	177	Stone	22	15	10.30 a.m., July 9, 1898.

[a] Stamped 68.475.

THE INTERNATIONAL BOUNDARY WEST OF THE SUMMIT OF THE ROCKY MOUNTAINS, AND THE MOOYIE TRAIL MONUMENT.

On August 11, 1856, a law was passed by Congress authorizing the appointment of a commission to unite with a similar commission to be appointed by Great Britain for the purpose of carrying into effect the first article of the treaty of June 15, 1846, that is to determine and mark the boundary line between the United States and British possessions westward from the summit of the Rocky Mountains. In February, 1857, Mr. Archibald Campbell was appointed commissioner for the United States, and Lieut. John G. Parke, United States Army, was appointed chief astronomer and surveyor. Three commissioners were appointed by Great Britain. Captains Prevost and Richards, of the Royal Navy, were first and second commissioners, respectively, their duties being limited to the determination of the water boundary referred to as "the channel which separates the Continent from Vancouver's Island." In the summer of 1858, Col. J. S. Hawkins, Royal Engineers, appointed by the British Government commissioner to determine the boundary line along the forty-ninth parallel, arrived in the United States prepared for field operations. At a meeting of the joint commission the following agreement relating to the plan of work was entered into:

> After discussing plans for determining and marking the line as far eastward as the Cascade Mountains, it was concluded to be inexpedient at the present time, in consequence of the great expense, consumption of time, and the impracticable nature of the country, to mark the whole boundary by cutting a track through the dense forest.
>
> It was therefore agreed to ascertain points on the line by the determination of astronomical points at convenient intervals on or near the boundary and to mark such astronomical stations, or points fixed on the parallel forming the boundary, by cutting a track of not less than 20 feet in width on each side for the distance of half a mile or more, according to circumstances. Further, that the boundary be determined and similarly marked where it crosses streams of any size, permanent trails, or any striking natural feature of the country.
>
> In the vicinity of settlements on or near the line it is deemed advisable to cut the track for a greater distance and to mark it in a manner to be determined hereafter.

Under this plan it seems that the work was prosecuted through the field seasons of 1858, 1859, and 1860, but owing to the war between the States, which followed soon after, all operations were suspended, and no detailed report was ever published.

The following is an extract from a short report by Mr. Archibald Campbell, United States commissioner, published in House Executive Document No. 86, Fortieth Congress, third session:

> The work of running and marking the land boundary was carried on through a country previously almost unknown. The forty-ninth parallel extends over rugged and precipitous mountains that attain great elevation, and in the Cascade

Range, on and near the boundary, perpetual snow covers many of the peaks, whose northern gorges are filled up with immense glaciers. The timber on the western slope of the Cascade Mountains is dense, being a heavy growth of pine and fir that in many places stands over a fallen forest not yet decayed. This is the character of the country as far eastward as the valley of the Similkameen River, one of the tributaries of the Columbia. Here the timber becomes more open and surveying operations less difficult.

After passing the Okinokane River, which is the lowest line of the great valley between the Cascade and the Rocky Mountains, the country again becomes rough and the timber more dense, but less so than the western slope of the Cascade Mountains.

It being impossible to follow the forty-ninth parallel continuously, the line of survey was carried over the nearest practicable route for a pack trail, connecting each astronomical station, making a total length of line of survey of about 800 miles. Astronomical stations were established by parties of the joint commission at almost every accessible point from which the boundary line is ascertained, and marked by a vista across all valleys and trails, where rough stone monuments were erected over posts buried in the ground to indicate the exact line.

The reconnoissance work extends over an area of about 30,000 square miles. Within this space the barometrical heights of over 800 points have been obtained.

A magnetic survey, extending over a range of 30° 20′ in latitude and 4° in longitude, with the necessary observations of the magnetic elements of the astronomical stations, was also made.

The entire length of the land boundary line is over 9° in longitude, or about 410 miles, and the length of the route traveled in surveying it is double that distance. Trails had to be opened for three-fourths of the distance traveled, involving great labor in cutting, grading, and bridging to make the route practicable for pack-mule transportation. The water courses were numerous and rapid, rendering the fords frequent and dangerous, and a slight rise of many of the streams would have made them impassable but for the timely precaution of building bridges at small streams and ferryboats at the river crossings. Many of the trails opened are now traveled routes to the mines then and since discovered, which are rapidly developing that section of the country, where almost every valley of any extent affords facilities for agricultural pursuits.

In collating the results of the survey reports upon the geology, botany, and natural history of the country reconnoitered were prepared and complete maps, on a large scale, made of the entire boundary and the adjacent country. A general map has also been made, showing the extent of the country traversed. And to facilitate the survey of the public lands photographic duplicates of the detailed sheets, showing each monument on the boundary line, with its geographical position, were furnished to the General Land Office. Photographic duplicates of the detailed sheets of the water boundary have also been made and furnished the Department of State in illustration of the question of the boundary channel.

Copies of the maps referred to in Mr. Campbell's reports are in existence. The boundary-line maps are in 14 sheets, with the title, Detailed Maps of the Northwest Boundary, from Point Roberts to the Rocky Mountains, between the United States and the British Possessions, under the treaty of June 15, 1846, showing monuments, cuts, and other marks. The scale of the maps is 1:60,000, and the topography is shown in hachures. The general map referred to is in contours and apparently on the same scale as the detailed maps.

From an inspection of the detailed map it appears that there are two portions of the boundary line which seem to be adequately marked, one of them being from Point Roberts, on Juan de Fuca Strait, eastward for a distance of about 41 miles, and the other being from Similkameen River, across the northern boundary of what was formerly the Colville Indian Reservation, to the Columbia River, a distance of about 91 miles; the eastern part of this latter portion, however, is not so well marked as the western part.

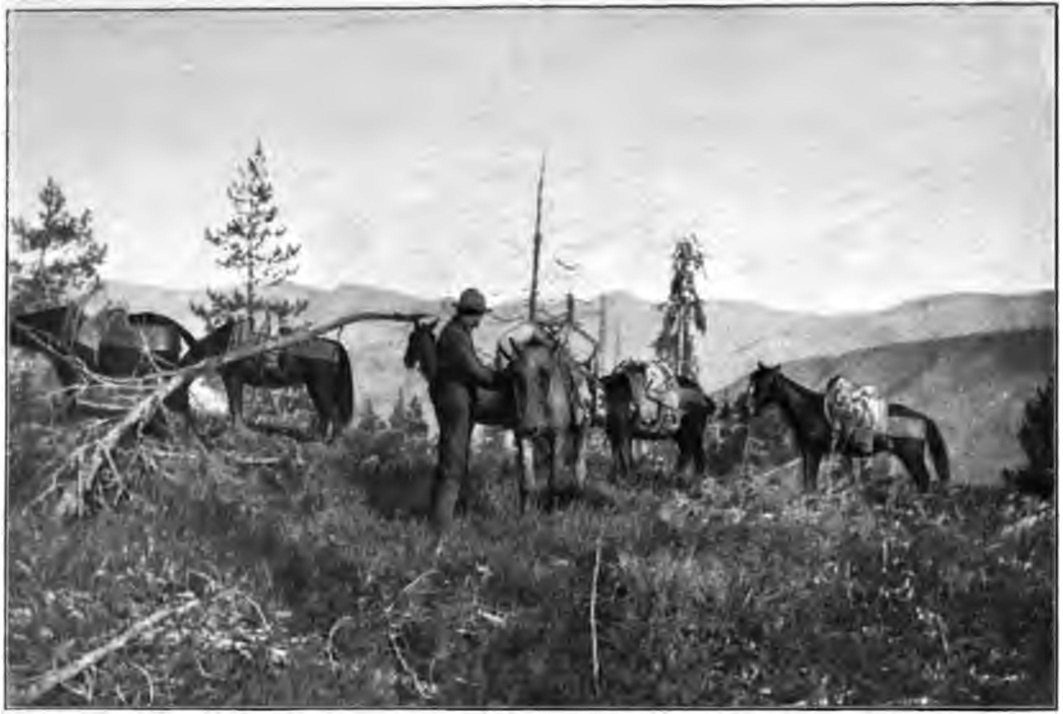
The portions which are inadequately marked—in fact, not marked at all—comprise intervals as follows:

Portions of international boundary west of the summit of the Rocky Mountains and the Mooyie Trail monument which are not marked.

	Miles (approximate).
West slope of Cascade Mountains	16
Across summit of Cascade Mountains to Pasayten River	54
Pasayten River to one hundred and twentieth meridian	24
One hundred and twentieth meridian to Similkameen River	15
Columbia River to Clark Fork	10
Clark Fork to Kootenai Mountain	11
Kootenai Mountain to Kootenai River	28
Kootenai River to Mooyie Trail	15
Mooyie River to Yaak River	25
Yaak River to summit west of Kootenai River	17
Summit west of Kootenai River to Kootenai River	5
Kootenai River to summit	5
Summit to Wigwam River	14
Wigwam River to Flathead River	14
Flathead River to Kishemeen Creek	4
Kishemeen Creek to summit of Rocky Mountains	13

There is no question as to the desirability of properly marking the boundary line, although it is true that the unmarked portions are in a rough, mountainous, and unsettled section, and the expense and labor connected with making the necessary resurveys and placing monuments would be large.

When the boundary line between Idaho and Montana was run northward to the international boundary, it was not possible to locate its terminal point as satisfactorily as might have been desired, because of the fact that there was no monument on the international boundary within a reasonable distance with which a connection could be made. The same is true of the boundary line between Washington and Idaho, and also of a guide meridian run by the Geological Survey northward from the thirteenth standard parallel in Idaho. The Washington Forest Reserve, the Priest River Forest Reserve, and the Flathead Forest Reserve abut against this boundary, and in making the topographic survey of these reserves, as well as in projecting the public-land lines northward, it is very important that there should be well-defined monuments to which these surveys can be connected. There are, of course, many other apparent reasons



SUMMIT OF BITTERROOT MOUNTAINS, SHOWING PACK TRAIN LOADED WITH SECTIONS OF GRANITE MONUMENT.

why the international boundary should be permanently and conspicuously marked, but special reference is made to those mentioned, for they have a bearing on the work of the Geological Survey.

As the instructions relating to the Idaho-Montana boundary line provided for a connection by triangulation or other methods with a monument on the international boundary, inquiry was made at the State Department for information on the subject and permission was granted to examine the records of the Northwest Boundary Survey. A visit was made to the manuscript room of the Department, and several lists of geographical positions were found. As these positions have not been published heretofore, two lists are given below. The second list gives geographical positions, and is signed by officers of the British and American commissions.

Extracts from State Department records of United States Northwest Boundary Survey.

[In lead-colored chest in manuscript room.]

Camp Columbia	[1] 117° 37′ 33″.9 on brink of hill, west bank of river.
	[1] 117° 37′ 05″.2 near east bank of river.
Camp Kootenay West	116° 35′ 44″.9 on side of mountain, west side of valley.
	116° 31′ 05″.9 on brow of first hill, right bank of river.
Camp Mooyie	116° 12′ 22″.3 on side of mountain, west side of valley.
	116° 11′ 54″.5 on plateau above creek. Position approximate.
	116° 11′ 25″.6 on left bank of creek close to water.
	116° 11′ 24″ on high bluff left bank. Position approximate.
Camp Kootenay East	115° 16′ 01″.4 on east bank of ravine beyond which the mountains rise.
	115° 11′ 11″.2 on right bank of Kootenay River.
	115° 10′ 11″.6 on second plateau, left bank of river.
	115° 03′ 28″.7 at foot of mountain, left bank small creek. (N. B.—This station was moved from its position as placed by the United States surveyors by the British surveyors. Description is of the new position.)

	Lat. N.			Long. W. Gr.		
	°	′	″	°	′	″
Camp Columbia	48	59	50.4	117	37	41.8
Fort Shepherd Station	49	00	00.0	117	37	19.4
Junction of Salmon River with Clarks Fork	49	01	32.4	117	23	24.5
Pend O'Reille Station	49	00	03.5	117	21	52.9
Kootenay Mountain Station	49	00	12.8	117	10	48.4
Triangulation pole	48	58	48.0	117	00	33.1
Sinyakuateen depot	48	09	23.8	116	43	42.9
Camp Kootenay West	48	59	55.1	116	31	16.2
Junction of trails near Acklewcache	48	54	21.4	116	22	02.1
Mooyie Trail monument	49	00	01.3	116	14	59.2
Camp Mooyie	49	01	26.0	116	12	40.5
Yaht Station	48	59	55.4	115	38	51.0

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[1] Monuments changed by English commission after verification.

From the foregoing list it appeared that the Mooyie Trail monument was the point on the international boundary nearest the Idaho-Montana boundary line, and Mr. Perkins was instructed to make a search for it. The monument is about 32 miles from Bonners Ferry, Idaho, and is easily reached by the new Wild Horse trail. It is on the west side of and near the trail between Round Meadows hay ranch, or Walters Prairie, and Mooyie River, and about 5 miles from the former. It is about a half mile beyond a section of the trail which for a distance of about one-fourth mile is filled with loose rock. As the monument is approached the trail passes through a heavy growth of timber and underbrush. The monument consists of a large pile of partly angular rocks, now knocked down by fallen trees. Originally, the trees in the immediate vicinity of the monument were cut down.

It will be observed that the latitude for the Mooyie Trail monument given in the list signed by the officers of the United States and British commissions is 49° 00′ 01″.3, or 1″.3 (about 132 feet) north of the parallel constituting the international boundary, and it was supposed that the point marked by the monument was in that latitude, and therefore not exactly on the international boundary. During the field season of 1898 the triangulation was extended so as to locate this monument, and its position deduced from the Spokane base is as follows: Latitude, 49° 00′ 01″.51; longitude, 116° 14′ 19″.48.

The check in latitude, 21 feet, was considered very satisfactory, and even the discrepancy in longitude, about 2,647 feet, was not more than might be expected, considering the lack of telegraphic facilities at the time of the Northwest Boundary survey. The point determined as the true one for the intersection of the international boundary and the Idaho-Montana boundary line was located with reference to the Mooyie Trail monument, so that there need be no large discrepancy, except that due to station error, when the international boundary is ultimately traced and marked, it being assumed that the work already done by the Northwest Boundary survey will be accepted and utilized.

The distance from the point on the Idaho-Montana boundary line at the crest of the Bitterroot Mountains to the international boundary, used in placing the initial monument, was computed as follows, the constants being taken from United States Coast and Geodetic Survey Report, 1884, Appendix No. 6:

	Latitude. °	′	″
Transit station, crest of Bitterroot Mountains	47	58	35.56
International parallel	49	0	0.00
Difference	1	01	24.44

	1° =69.097 miles=364,832 feet.	
	1′ =1,853.16 meters.	
log.	1″ =30.886 meters,	1.489762
log.	24″.44	1.388101
log.	754.85 meters =	2.877863
	1,853.16	
log.	2,608.01 meters,	3.416309
log.	meters to feet,	0.515984
log.	8,554 feet =	3.932293
	364,832	
	373,386 feet.	
Correction[1] =	+21	
	373,407 feet, total distance.	

FINANCIAL STATEMENT.

A financial statement is presented below showing how the amount appropriated for the survey of the boundary line was expended. As already mentioned, however, this amount does not represent the entire cost of the work, for the greater portion of the animals and outfit were transferred from other localities, where they had been used by parties of the Geological Survey working under other appropriations. Further, it was possible to use a portion of the triangulation done in connection with the forest surveys, and the expenses of the party while engaged in sketching topography were charged in part against the appropriation for topographic surveys. No portion of the salary of the geographer in charge of the work was paid from the appropriation for the boundary line, nor were any office salaries charged against it. But for this material assistance, which did not in any way detract from other work, the cost of the boundary survey would probably have been increased more than twofold. On the other hand, a large portion of what was accomplished in connection with the boundary line can be utilized in other directions. The appropriation of $7,650 was originally made for expenditure during the fiscal year ending June 30, 1898. The unexpended balance on that date was, however, made available by act of Congress for the year ending June 30, 1899, and again, in a similar manner, the unexpended balance at the latter date was reappropriated for the fiscal year ending June 30, 1900. The appropriation became practically exhausted in October, 1899.

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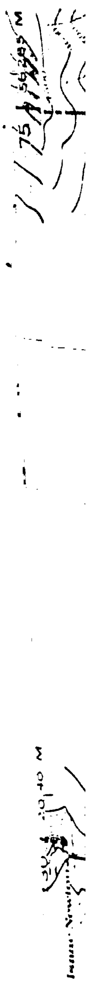
[1] By triangulation connection with Mooyie Trail monument, the position of this monument is 0″.21 farther north than as given by the international boundary survey, hence to reduce all positions to the international-boundary survey system, latitudes of United States Geological Survey triangulation are decreased 0″.21, or its equivalent, 21 feet, the distance from initial point on Bitterroot Mountains to forty-ninth parallel being increased 21 feet.

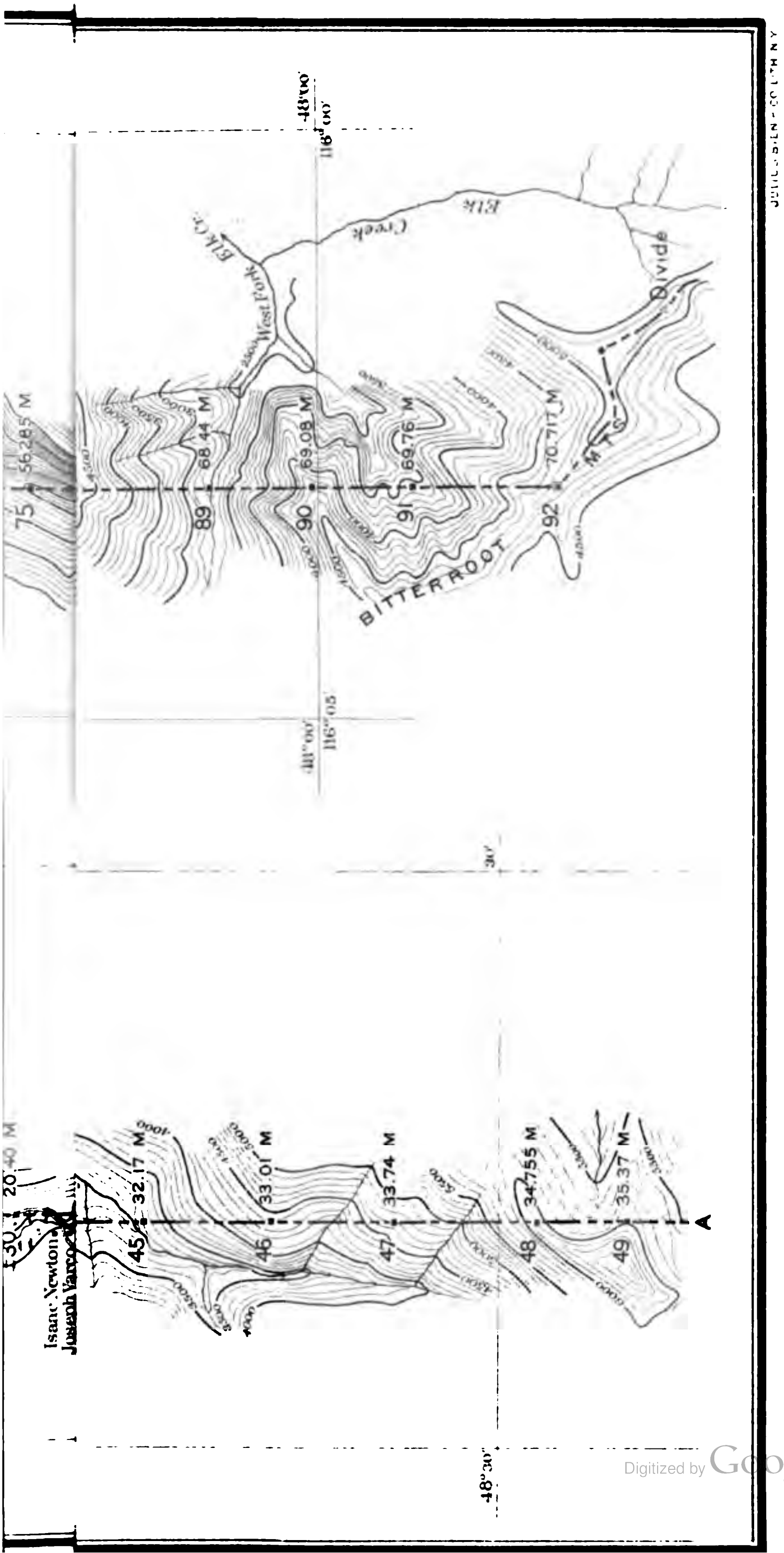
Financial statement relating to appropriation for survey of boundary line between Idaho and Montana.

Date.		To whom paid.	For what paid.	Amount.
1897.				
June	30	E. T. Perkins, jr., topographer	Services, June 8-30	$101.10
July	3	....do	Traveling expenses	60.75
	10	G. M. Metzler	Shoeing, etc	23.00
	10	Isaac I. Lewis	Tollage supplies, etc	13.57
	10	Lindsay & Merriam	Subsistence supplies	61.04
	10	F. O. Berg	Tentage	19.90
	10	Holly, Mason, Marks & Co	Hardware	52.50
	10	Spokane Dry Goods Co	Saddles, blankets, and pack covers	43.48
	12	Mark E. Davis	Saddlery, etc	32.50
	12	S. H. Rush	Saddlery, etc	33.75
	15	E. T. Perkins, jr	Field expenses	160.56
	24	E. C. Murphy	One mule	30.00
	29	E. T. Perkins, jr	Field expenses	73.05
	31	Pay roll of employees	Services, July, 1897	241.60
Aug.	7	C. P. Willis	One horse	15.00
	17	Exchange National Bank	Horses and mules	143.10
	17	E. T. Perkins, jr	Field expenses	116.12
	19	United States Express Co	Freight	46.57
	25	Chicago and Northwestern Railway Co.	Transportation	12.50
	31	Pay roll of employees	Services, August, 1897	241.60
Sept.	4	E. T. Perkins, jr	Field expenses	120.65
	4	S. H. Rush	Harness	34.50
	8	Richard Smith	Wagon	75.00
	11	Oregon Short Line R. R	Transportation	50.69
	28	E. T. Perkins, jr	Field expenses	50.65
	30	Pay roll of employees	Services, September, 1897	213.80
Oct.	11	H. Baumgarten	Stamps	.30
	14	John O'Connell	Transportation	20.00
	18	Young & Sons	Transit	255.00
	30	E. T. Perkins, jr	Field expenses	192.56
	31	Pay roll of employees	Services, October, 1897	236.60
Nov.	11	Northern Pacific Railway Co	Transportation	4.25
	15	E. T. Perkins, jr	Field expenses	196.44
Dec.	4	Pay roll of employees	Services, November, 1897	193.97
	8	Schoellhorn-Albrecht Machine Co	Iron monuments	208.33
	20	E. T. Perkins, jr	Field expenses	106.45
1898.				
Jan.	13	Northwestern Storage and Transportation Co.	Storage	4.50
	17	....do	....do	2.85
Feb.	10	P. Morrison	Pasturage	36.50
	12	H. L. Schermerhorn	Storage	4.50
Mar.	12	....do	....do	4.50
	15	Western Union Telegraph Co	Telegrams	3.84
	15	....do	....do	.80
	31	P. Morrison	Pasturage	15.00
Apr.	8	H. Louis Schermerhorn	Storage	4.50
	14	P. Morrison	Pasturage	15.00
May	10	Northwestern Storage and Transportation Co.	Storage	4.50
	10	P. Morrison	Pasturage	15.00

Financial statement relating to appropriation for survey of boundary line between Idaho and Montana—Continued.

Date.	To whom paid.	For what paid.	Amount.
1898.			
June 8	P. Morrison	Pasturage	$15.00
11	H. Louis Schermerhorn	Storage	4.50
July 13	Lindsay & Hall	Subsistence supplies	59.45
Aug. 3	Pay roll of employees	Services, July, 1898	414.67
11	Arend & Kenward	Subsistence supplies	36.00
11	Holly, Mason, Marks & Co	Hardware	10.90
11	P. Morrison	Pasturage	15.00
17	D. L. Reaburn	Field expenses	59.08
Sept. 13	....do	....do	35.30
13	R. U. Goode	....do	23.15
13	Gordon Daugherty	Subsistence supplies	49.41
13	Pay roll of employees	Services, August, 1898	473.06
13	Giles & Peat	Stone monuments	58.00
13	D. L. Reaburn	Field expenses	43.77
21	Oregon Railroad and Navigation Co.	Transportation	16.65
21	F. B. Collow	Subsistence supplies	77.54
21	Northern Pacific Railway Co.	Transportation	32.10
Oct. 11	Pay roll of employees	Services, September, 1898	465.00
14	W. E. R. Brewster	Subsistence supplies	79.80
Nov. 7	Pay roll of employees	Services, October, 1898	425.00
7	D. L. Reaburn	Field expenses	189.68
16	....do	....do	161.12
26	....do	....do	137.17
26	Northern Pacific Railway Co	Transportation	9.90
Oct. 19	Southern Pacific Co	....do	88.00
19	....do	....do	17.05
Dec. 12	S. W. Johnson	Pasturage	13.65
1899.			
Jan. 17	Great Northern Railway Co.	Transportation	15.15
Feb. 16	United States Express Co	Expressage	10.65
Mar. 20	Western Union Telegraph Co	Telegrams	.90
20	....do	....do	.48
June 30	Pay roll of employees	Services, June, 1899	316.67
July 17	D. L. Reaburn	Field expenses	213.75
31	Pay roll of employees	Services, July, 1899	352.10
Aug. 8	E. J. Brooks & Co	Steel dies and letters	2.12
Sept. 12	D. L. Reaburn	Field expenses	152.96
16	....do	....do	21.40
	Total		7,649.50
	Amount appropriated		7,650.00
	Balance		.50





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UNITED STATES GEOLOGICAL SURVEY
CHARLES D. WALCOTT, DIRECTOR

BOUNDARIES

OF

THE UNITED STATES

AND OF THE

SEVERAL STATES AND TERRITORIES

WITH AN OUTLINE OF THE

HISTORY OF ALL IMPORTANT CHANGES OF TERRITORY

(SECOND EDITION)

BY

HENRY GANNETT

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LETTER OF TRANSMITTAL.

Department of the Interior,
United States Geological Survey,
Washington, D. C., April 14, 1900.

Sir: I have the honor to submit herewith a sketch of the boundaries of the United States, the several States, and the Territories, as defined by treaty, charter, or statute. Besides giving the present status of these boundaries I have endeavored to present an outline of the history of all important changes of territory, with the laws appertaining thereto.

The work constitutes a revised and enlarged edition of Bulletin No. 13, published in 1885.

Very respectfully,

Henry Gannett,
Geographer.

Hon. C. D. Walcott,
Director United States Geological Survey.

BOUNDARIES OF THE UNITED STATES AND OF THE SEVERAL STATES AND TERRITORIES, WITH AN OUTLINE OF THE HISTORY OF ALL IMPORTANT CHANGES OF TERRITORY.

By Henry Gannett.

CHAPTER I.

BOUNDARIES OF THE UNITED STATES, AND ADDITIONS TO ITS TERRITORY.

BOUNDARIES OF THE UNITED STATES.

Provisional Treaty with Great Britain.

The original limits of the United States were first definitely laid down in the provisional treaty made with Great Britain in 1782. The second article of that treaty defines its boundaries as follows:

From the northwest angle of Nova Scotia, viz, that angle which is formed by a line drawn due north from the source of St. Croix river to the highlands; along the Highlands which divide those rivers that empty themselves into the river St. Lawrence, from those which fall into the Atlantic Ocean, to the northwesternmost head of Connecticut River; thence down along the middle of that river to the forty-fifth degree of north latitude; from thence, by a line due west on said latitude until it strikes the river Iroquois or Cataraquy (St. Lawrence); thence along the middle of said river into Lake Ontario, through the middle of said lake until it strikes the communication by water between that lake and Lake Erie; thence along the middle of said communication into Lake Erie, through the middle of said lake until it arrives at the water communication between that lake and Lake Huron; thence along the middle of said water communication into the Lake Huron; thence through the middle of said lake to the water communication between that lake and Lake Superior; thence through Lake Superior northward of the Isles Royal and Phelippeaux to the Long Lake; thence through the middle of said Long Lake, and the water communication between it and the Lake of the Woods, to the said Lake of the Woods; thence through the said lake to the most northwestern point thereof, and from thence on a due west course to the river Mississippi; thence by a line to be drawn along the middle of the said river Mississippi until it shall intersect the northernmost part of the thirty-first degree of north latitude. South by a line to be drawn due east from the determination of the line last mentioned, in the latitude of thirty-one degrees north of the Equator, to the middle of the river Apalachicola or Catahouche; thence along the middle thereof to its junction with the Flint River; thence strait to the head of St. Mary's River; and thence down along the middle of St. Mary's River to the Atlantic Ocean. East by a line to be drawn along the middle of the river St. Croix, from its mouth in the Bay of Fundy to its source, and from its source directly north to the aforesaid highlands which divide the rivers that fall into the Atlantic Ocean from those which fall into the river St. Lawrence; comprehending all islands within twenty leagues of any part of the shores of the United States, and lying between lines to be drawn due east from the points where the aforesaid boundaries between Nova Scotia on the one part and East Florida on the other, shall respectively touch the Bay of Fundy and the Atlantic Ocean; excepting such islands as now are, or heretofore have been within the limits of the said province of Nova Scotia.

TREATY WITH SPAIN OF 1798.

The boundary between the United States and the Spanish Possessions, known as the Floridas, is reaffirmed in the treaty between the United States and Spain, made in 1795, in the following terms:

> The southern boundary of the United States, which divides their territory from the Spanish colonies of East and West Florida, shall be designated by a line beginning on the river Mississippi, at the northernmost part of the thirty-first degree of latitude north of the equator, which from thence shall be drawn due east to the middle of the river Apalachicola or Catahouche, thence along the middle thereof to its junction with the Flint; thence straight to the head of St. Mary's River, and thence down the middle thereof to the Atlantic Ocean.

DEFINITIVE TREATY WITH GREAT BRITAIN.

The definitive treaty of peace with Great Britain, concluded September 3, 1783, defines the boundaries of the United States in terms similar to those of the provisional treaty.

The northern boundary became at once a fruitful source of dissension between the two countries. From the time of the conclusion of peace almost to the present day this line has been the subject of a series of treaties, commissions, and surveys for the purpose of interpreting its terms.

The following is in outline a history of the settlement of this boundary:

TREATY OF LONDON, 1794.

The fourth article of the treaty of London, signed November 19, 1794, provided that—

> Whereas it is uncertain whether the river Mississippi extends so far to the northward as to be intersected by a line to be drawn due west from the Lake of the Woods in the manner mentioned in the treaty of peace between His Majesty and the United States, etc., the two parties will proceed by amicable negotiation to regulate the boundary line in that quarter.

This matter was not settled, however, until 1818.

The fifth article of the same treaty makes provision for settling another doubtful point, as follows:

> Whereas doubts have arisen what river was truly intended under the name of the river St. Croix mentioned in the said treaty of peace, and forming a part of the boundary therein described, that question shall be referred to the final decision of commissions to be appointed in the following manner, viz.

Here follow provisions that His Majesty and the President of the United States should each appoint a commissioner, and that these two commissioners should agree on a third, or, they failing to agree on the third, he was to be chosen by lot in their presence.

Which was the true St. Croix River had been a matter of controversy between the governments of Massachusetts and Nova Scotia since the year 1764.

The commissioners appointed under the foregoing provisions decided, on the 25th of October, 1798, the river called Schoodiac and the northern branch thereof (called Cheputnaticook) to be the true river St. Croix, and that its source was at the northernmost headspring of the northern branch aforesaid. A monument was erected at that spot under the direction of the commissioners. (See Memoirs of Northeastern Boundary, Gallatin, pages 7, 8.)

TREATY OF GHENT.

By the treaty of peace concluded at Ghent, December 24, 1814, it was agreed to provide for a final adjustment of the boundaries described in the treaty of 1783, which had not yet been ascertained and determined, embracing certain islands in the Bay of Fundy and the whole of the boundary line from the source of the river St Croix to the most northwestern point of the Lake of the Woods.

By article 4 provision was made for a board of commissioners to settle the title to several islands in the Bay of Passamaquoddy, which is a part of the Bay of Fundy, and the island of Grand Menan in the said Bay of Fundy.

The fifth article made provision for a board of commissioners to settle the boundary from the source of the river St. Croix northward to the highland which divides those waters that empty themselves into the river St. Lawrence from those which fall into the Atlantic Ocean, thence along said highlands to the northwesternmost head of Connecticut River, thence down along the middle of that river to the forty-fifth degree of north latitude, thence due west on said latitude until it strikes the river Iroquois or Cataraquy (St. Lawrence).

The sixth and seventh articles provided for commissioners to continue the line to the northwestern point of the Lake of the Woods.

(For further details see treaty, Statutes at Large, vol. 8, pages 220-2.)

It was provided by this treaty that in case any of the boards of commissioners were unable to agree, they should make separately or jointly a report or reports to their respective Governments stating the points on which they differed, the grounds on which they based their respective opinions, etc.

These reports were to be referred to some friendly sovereign or state for arbitration.

The first and third boards of commissioners above mentioned came to an agreement, and those portions of the boundary were thus finally settled; but the commission appointed under the fifth article, after sitting nearly five years, could not agree on any of the matters referred to them, nor even on a general map of the country exhibiting the boundaries respectively claimed by each party. They accordingly made separate reports to their Governments, stating the points on which they differed and the grounds upon which their respective opinions had been formed.

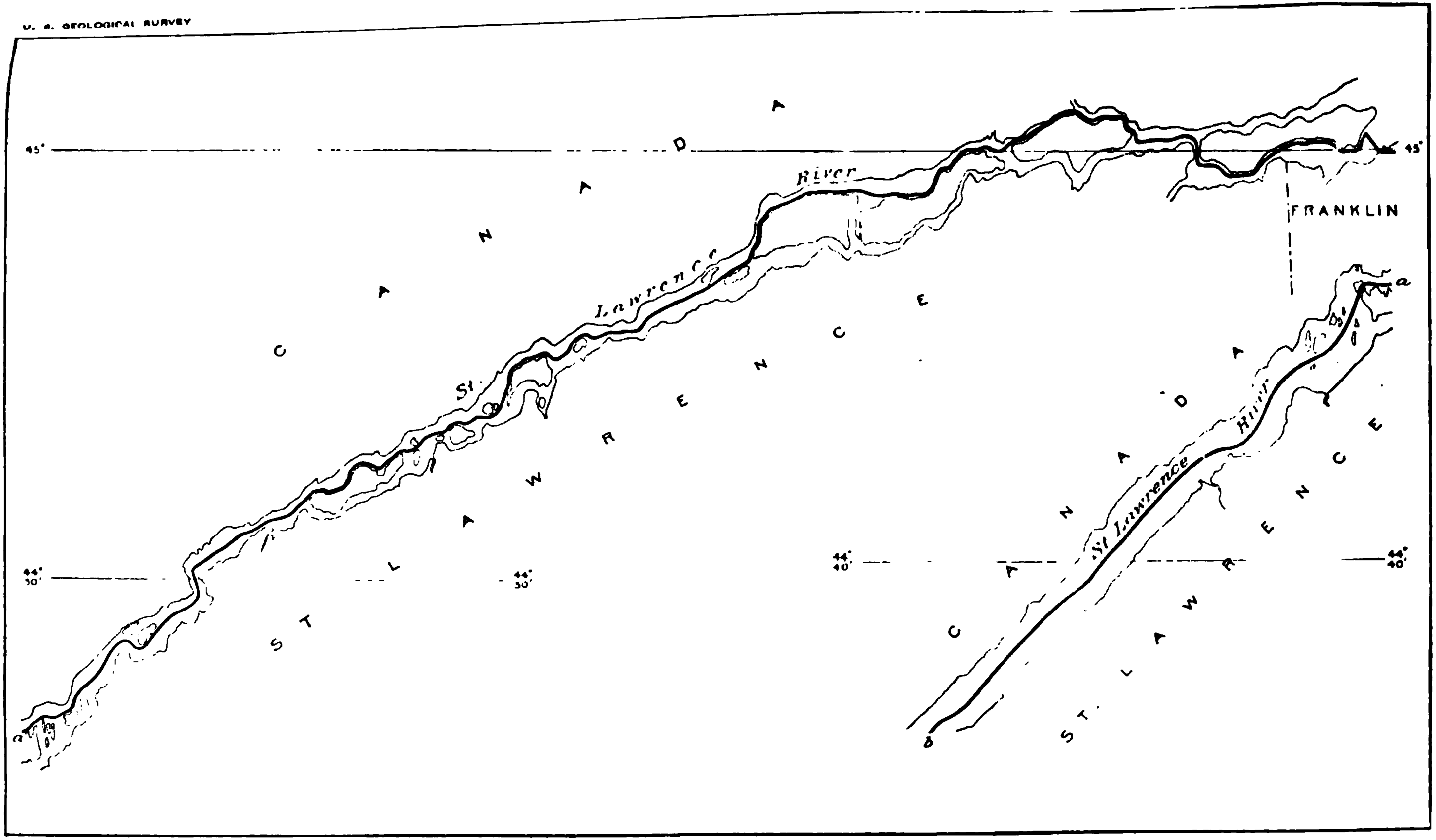
The first of these commissions awarded Moore, Dudley, and Frederick Islands to the United States, and all other islands in Passamaquoddy Bay, and the island of Grand Menan, to Great Britain.

The following is the text of the report of the third of these commissions which had under consideration that portion of the northern boundary between the point where the forty-fifth parallel of north latitude strikes the St. Lawrence and the point where the boundary reaches Lake Superior:

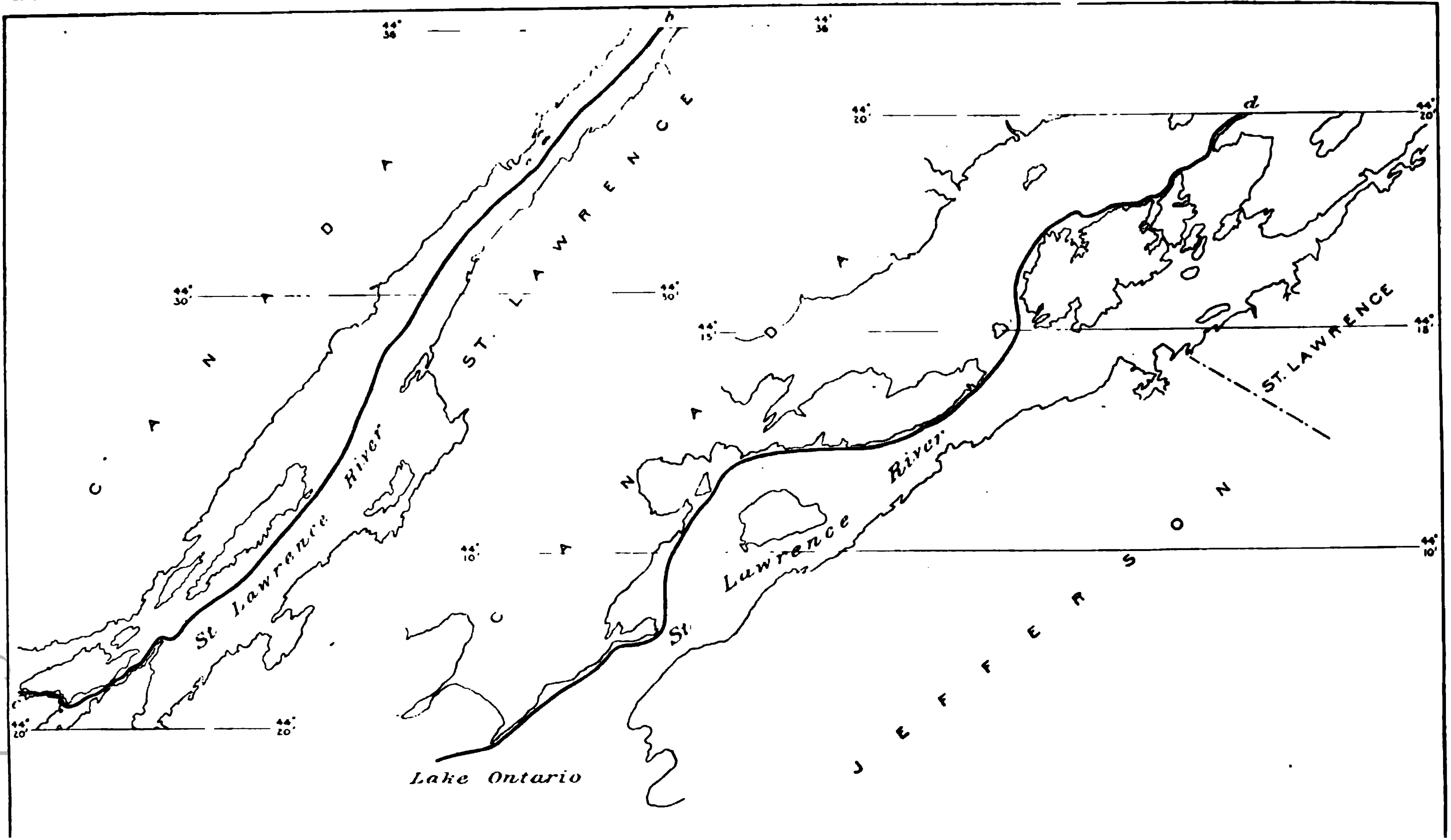
Decision of the commissioners under the sixth article of the treaty of Ghent, done at Utica, in the State of New York, 18th June, 1822.

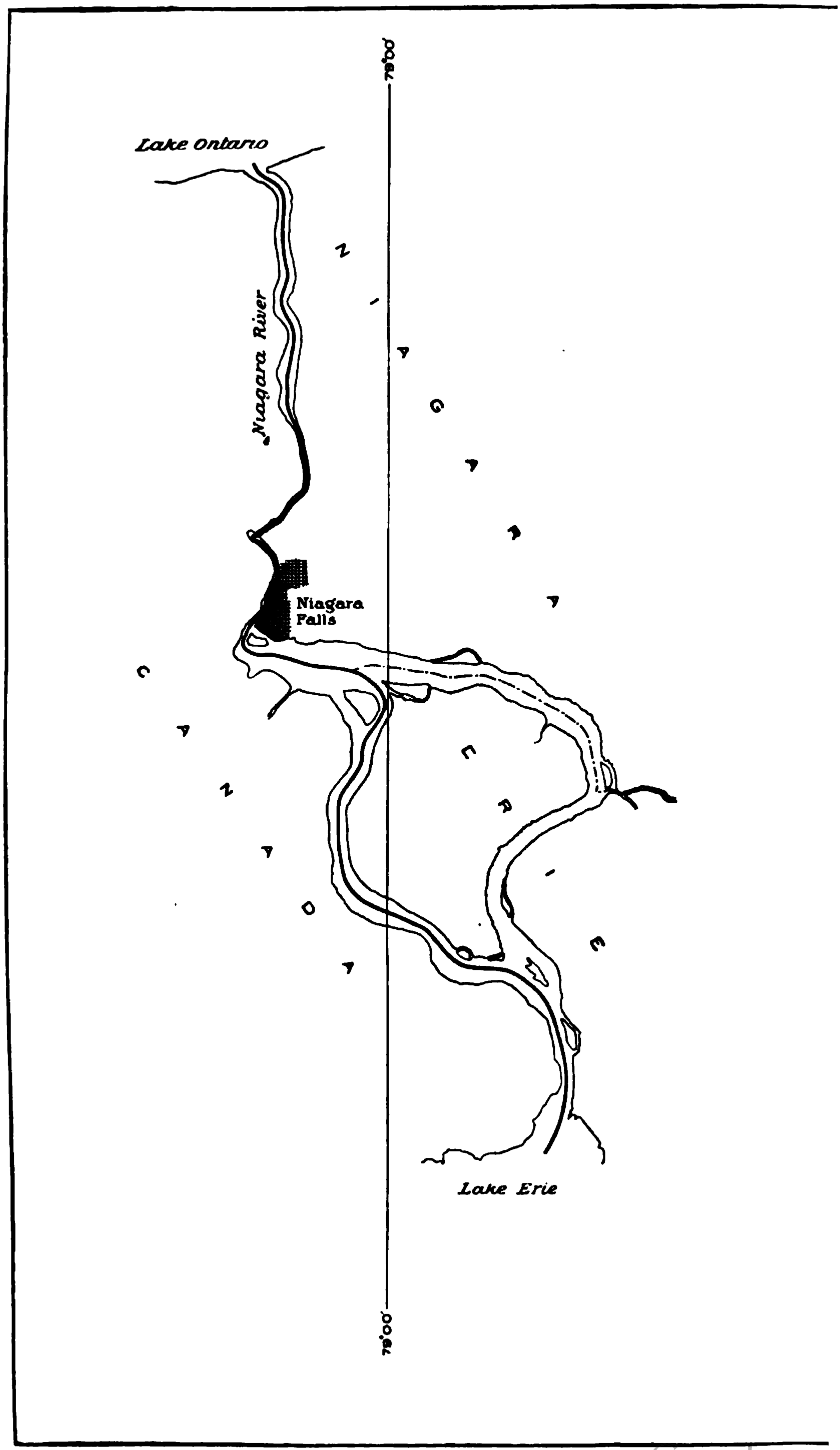
We do decide and declare that the following-described line (which is more clearly indicated on a series of maps accompanying this report, exhibiting correct surveys and delineations of all the rivers, lakes, water communications, and islands embraced by the sixth article of the treaty of Ghent, by a black line shaded on the British side with red and on the American side with blue; and each sheet of which series of maps is identified by a certificate, subscribed by the commissioners, and by the two principal surveyors employed by them) is the true boundary intended by the two beforementioned treaties, that is to say:

Beginning at a stone monument, erected by Andrew Ellicot, esq., in the year 1817, on the south bank or shore of the said river Iroquois, or Cataraqui (now called the St. Lawrence), which monument bears south 74° 45′ west, and is 1,840 yards distant from the stone church in the Indian village of St. Regis, and indicates the point at which the forty-fifth parallel of north latitude strikes the said river; thence running north 35° 45′ west into the river, on a line at right angles with the southern shore, to a point 100 yards south of the opposite island, called Cornwall Island; thence turning westerly and passing around the southern and western sides of said island, keeping 100 yards distant therefrom, and following the curvatures of its shores, to a point opposite to the northwest corner or angle of said island; thence to and along the middle of the main river until it approaches the eastern extremity of Barnhart's Island; thence northerly along the channel which divides the last-mentioned island from the Canada shore, keeping 100 yards distant from the island, until it approaches Sheik's Island; thence along the middle of the strait which divides Barnhart's and Sheik's Islands to the channel called the Long Sault, which separates the two last-mentioned islands from the lower Long Sault Island; thence westerly (crossing the center of the last-mentioned channel) until it approaches within 100 yards of the north shore of the Lower Sault Island; thence up the north branch of the river, keeping to the north of and near the Lower Sault Island, and also north of and near the Upper Sault, sometimes called Baxter's Island, and south of the two small islands marked on the map A and B, to the western extremity of the Upper Sault or Baxter's Island; thence, passing between the two islands called the Cats, to the middle of the river above; thence along the middle of the river, keeping to the north of the small islands marked C and D, and north also of Chrystler's Island, and of the small island next above it, marked E, until it approaches the northeast angle of Goose Neck Island; thence along the passage which divides the last-mentioned island fro mthe Canada shore, keeping 100 yards from the island to the upper end of the same; thence south of and near the two small islands called the Nut Islands; thence north of and near the island marked F, and also of the island called Dry or Smuggler's Island; thence passing between the islands marked G and H to the north of the island called Isle au Rapid Platt; thence along the north side of the last-mentioned island, keeping 100 yards from the shore, to the upper end thereof; thence along the middle of the river, keeping to the south of and near the islands called Coussin (or Tussin) and Presque Isle; thence up the river, keeping north of and near the several Gallop Isles numbered on the map 1, 2, 3, 4, 5, 6, 7, 8, 9, and 10, and also of Tick, Tibbits, and Chimney Islands, and south of and near the Gallop Isles numbered 11, 12, and 13, and also of Duck, Drummond, and Sheep Islands; thence along the middle of the river, passing north of island No. 14, south of 15 and 16, north of 17, south of 18, 19, 20, 21, 22, 23, 24, 25, and 28, and north of 26 and 27; thence along the middle of the river, north of Gull Island and of the islands Nos. 29, 32, 33, 34, 35, Bluff Island, and Nos. 39, 44, and 45, and to the south of Nos. 30, 31, 36, Grenadier Island, and Nos. 37, 38, 40, 41, 42, 43, 46, 47, and 48, until it approaches the east end of Well's Island; thence to the north of Well's Island, and along the strait which divides it



BOUNDARY BETWEEN NEW YORK AND CANADA IN ST. LAWRENCE RIVER.


CANADA
ST. LAWRENCE
St. Lawrence River
CANADA
St. Lawrence River
ST. LAWRENCE
JEFFERSON
Lake Ontario
b
c
d
44° 36'
44° 30'
44° 20'
44° 15'
44° 10'



BOUNDARY BETWEEN NEW YORK AND CANADA IN NIAGARA RIVER.

from Rowe's Island, keeping to the north of the small islands Nos. 51, 52, 54, 58, 59, and 61, and to the south of the small islands numbered and marked 49, 50, 53, 55, 57, 60, and H, until it approaches the northeast point of Grindstone Island; thence to the north of Grindstone Island, and keeping to the north also of the small islands Nos. 63, 65, 67, 68, 70, 72, 73, 74, 75, 76, 77, and 78, and to the south of Nos. 62, 64, 66, 69, and 71, until it approaches the southern point of Hickory Island; thence passing to the south of Hickory Island and of the two small islands lying near its southern extremity, numbered 79 and 80; thence to the south of Grand or Long Island, keeping near its southern shore, and passing to the north of Carlton Island, until it arrives opposite to the southwestern point of said Grand Island, in Lake Ontario; thence, passing to the north of Grenadier, Fox, Stony, and the Gallop Islands, in Lake Ontario, and to the south of and near the islands called the Ducks, to the middle of the said lake; thence westerly along the middle of said lake to a point opposite the mouth of the Niagara River; thence to and up the middle of the said river to the Great Falls; thence up the Falls through the point of the Horse Shoe, keeping to the west of Iris or Goat Island, and of the group of small islands at its head, and following the bends of the river so as to enter the strait between Navy and Grand Islands; thence along the middle of said strait to the head of Navy Island; thence to the west and south of and near to Grand and Beaver Islands, and to the west of Strawberry, Squaw, and Bird Islands to Lake Erie; thence southerly and westerly along the middle of Lake Erie in a direction to enter the passage immediately south of Middle Island, being one of the easternmost of the group of islands lying in the western part of said lake; thence along the said passage, proceeding to the north of Cunningham's Island, of the three Bass Islands, and of the Western Sister, and to the south of the islands called the Hen and Chickens, and of the Eastern and Middle Sisters; thence to the middle of the mouth of the Detroit River in a direction to enter the channel which divides Bois Blanc and Sugar Islands; thence up the said channel to the west of Bois Blanc Island, and to the east of Sugar, Fox, and Stony Islands, until it approaches Fighting or Great Turkey Island; thence along the western side and near the shore of said last-mentioned island to the middle of the river above the same; thence along the middle of said river, keeping to the southeast of and near Hog Island, and to the northwest of and near the island Isle à la Pêche, to Lake Saint Clair; thence through the middle of said lake in a direction to enter that mouth or channel of the river St. Clair, which is usually denominated the Old Ship Channel; thence along the middle of said channel, between Squirrel Island on the southeast and Herson's Island on the northwest, to the upper end of the last-mentioned island, which is nearly opposite to Point au Chênes, on the American shore; thence along the middle of the river Saint Clair, keeping to the west of and near the islands called Belle Rivière Isle and the Isle aux Cerfs, to Lake Huron; thence through the middle of Lake Huron in a direction to enter the strait or passage between Drummond's Island on the west and the Little Manitou Island on the east; thence through the middle of the passage which divides the two last-mentioned islands; thence, turning northerly and westerly, around the eastern and northern shores of Drummond's Island, and proceeding in a direction to enter the passage between the island of Saint Joseph's and the American shore, passing to the north of the intermediate islands Nos. 61, 11, 10, 12, 9, 6, 4, and 2, and to the south of those numbered 15, 13, 5, and 1; thence up the said last-mentioned passage, keeping near to the island Saint Joseph's, and passing to the north and east of Isle à la Crosse and of the small islands numbered 16, 17, 18, 19, and 20, and to the south and west of those numbered 21, 22, and 23, until it strikes a line (drawn on the map with black ink and shaded on one side of the point of intersection with blue and on the other with red) passing across the river at the head of Saint Joseph's Island and at the foot of the Neebish Rapids, which line denotes the termination of the boundary directed to be run by the sixth article of the treaty of Ghent.

And the said commissioners do further decide and declare that all the islands lying in the rivers, lakes, and water communications between the before-described boundary line and the adjacent shores of Upper Canada do, and each of them does, belong to His Britannic Majesty, and that all the islands lying in the rivers, lakes, and water communications between the said boundary line and the adjacent shores of the United States or their territories do, and each of them does, belong to the United States of America, in conformity with the true intent of the second article of the said treaty of 1783, and of the sixth article of the treaty of Ghent.

In accordance with the terms of this treaty, a survey was made of the St. Lawrence and the Great Lakes, and a map prepared. This was photolithographed and published, in 29 sheets, by the United States Light-House Board, in 1891.

By the second article of the convention with Great Britain—1818—the boundary line was extended westward along the forty-ninth parallel of latitude to the "Stony" (Rocky) Mountains, while beyond these mountains the treaty provided that the country should remain open to both parties. The terms of the treaty are as follows:

ARTICLE 2. It is agreed that a line drawn from the most northwestern point of the Lake of the Woods along the forty-ninth parallel of north latitude, or if the said point shall not be in the forty-ninth parallel of north latitude, then that a line drawn from the said point due north or south, as the case may be, until the said line shall intersect the said parallel of north latitude, and from the point of such intersection due west along and with the said parallel, shall be the line of demarkation between the territories of the United States and those of His Britannic Majesty, and that the said line shall form the northern boundary of the said territories of the United States and the southern boundary of the territories of His Britannic Majesty from the Lake of the Woods to the Stony Mountains.

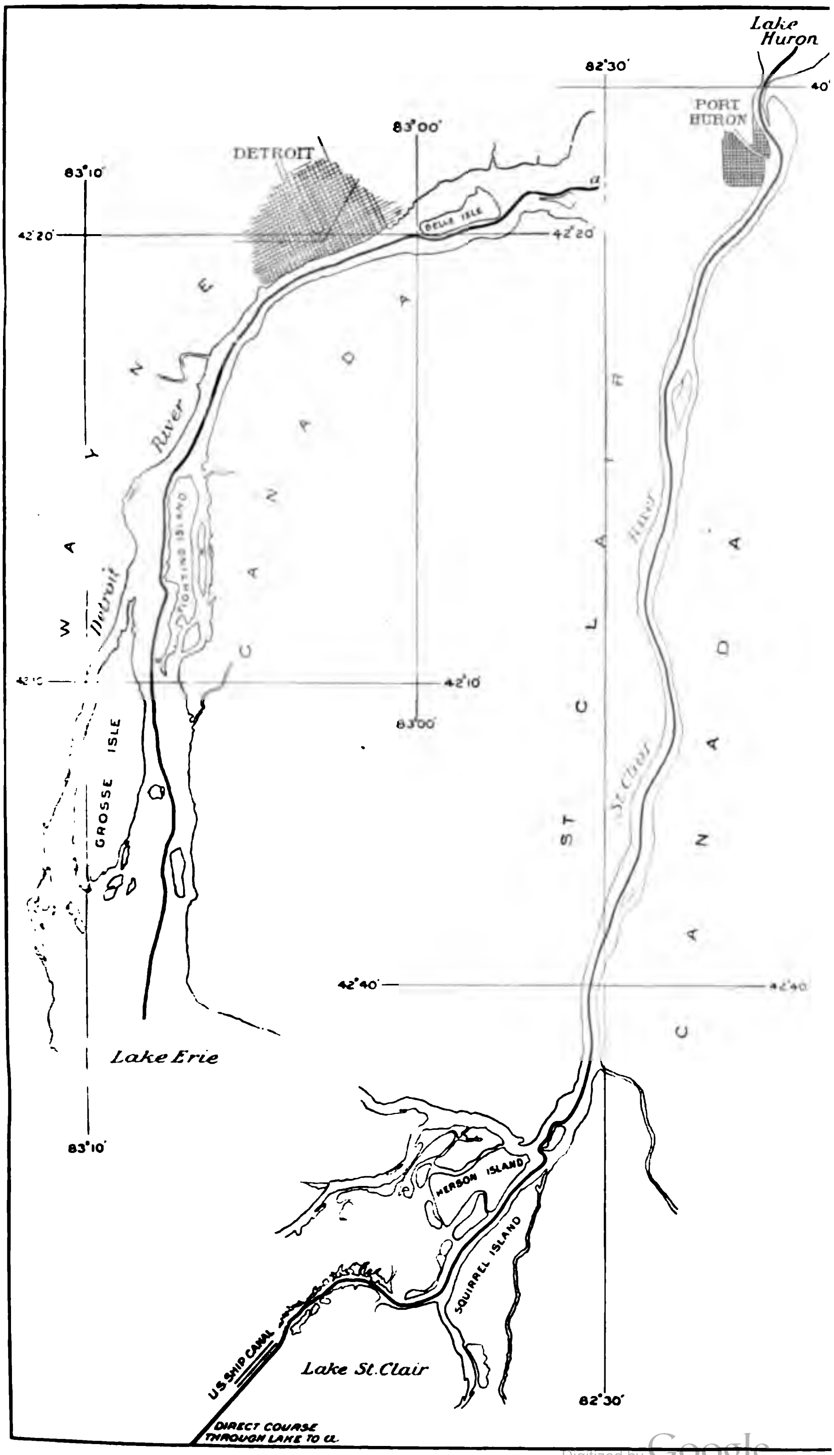
ARTICLE 3. It is agreed that any country that may be claimed by either party on the northwest coast of America, westward of the Stony Mountains, shall, together with its harbours, bays, and creeks, and the navigation of all rivers within the same, be free and open, for the term of ten years from the date of the signature of the present convention, to the vessels, citizens, and subjects of the two powers; it being well understood that this agreement is not to be construed to the prejudice of any claim which either of the two high contracting parties may have to any part of the said country, nor shall it be taken to affect the claims of any other power or state to any part of the said country; the only object of the high contracting parties in that respect being to prevent disputes and differences amongst themselves.

In 1824 negotiations were resumed between the two countries for the settlement, among other things, of the boundary west of the Rocky Mountains, but no conclusion was reached; the claim of the English Government being that the boundary line should follow the forty-ninth parallel westward to the point where this parallel strikes the great northwestern branch of Columbia River, thence down the middle of that river to the Pacific Ocean.

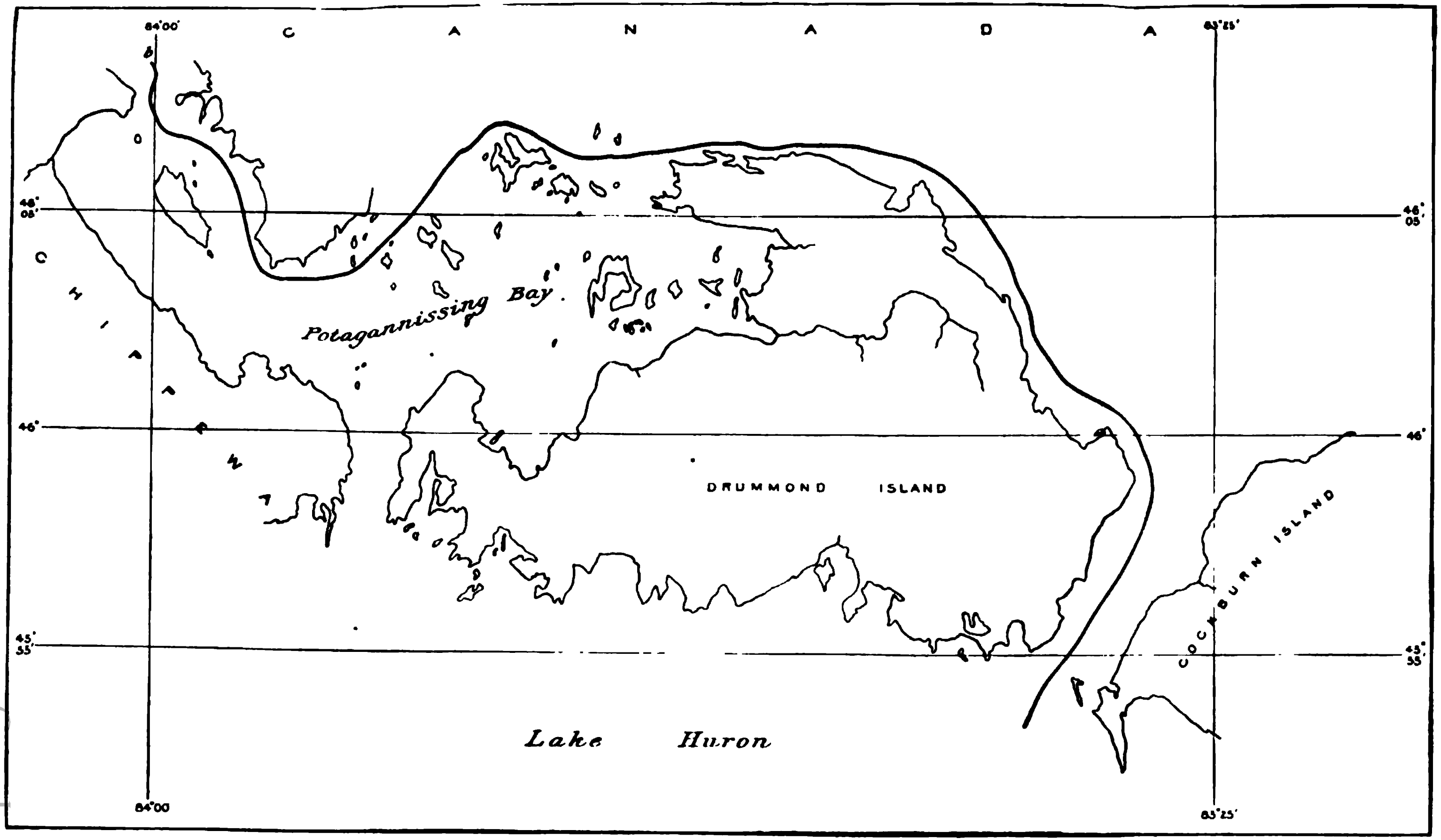
In 1826 negotiations were resumed, and several compromises were proposed by both parties, but without satisfactory results. After this the whole matter remained in abeyance until the special mission of Lord Ashburton to this country in 1842.

Meanwhile the unsettled questions regarding the northeastern boundary again came up.

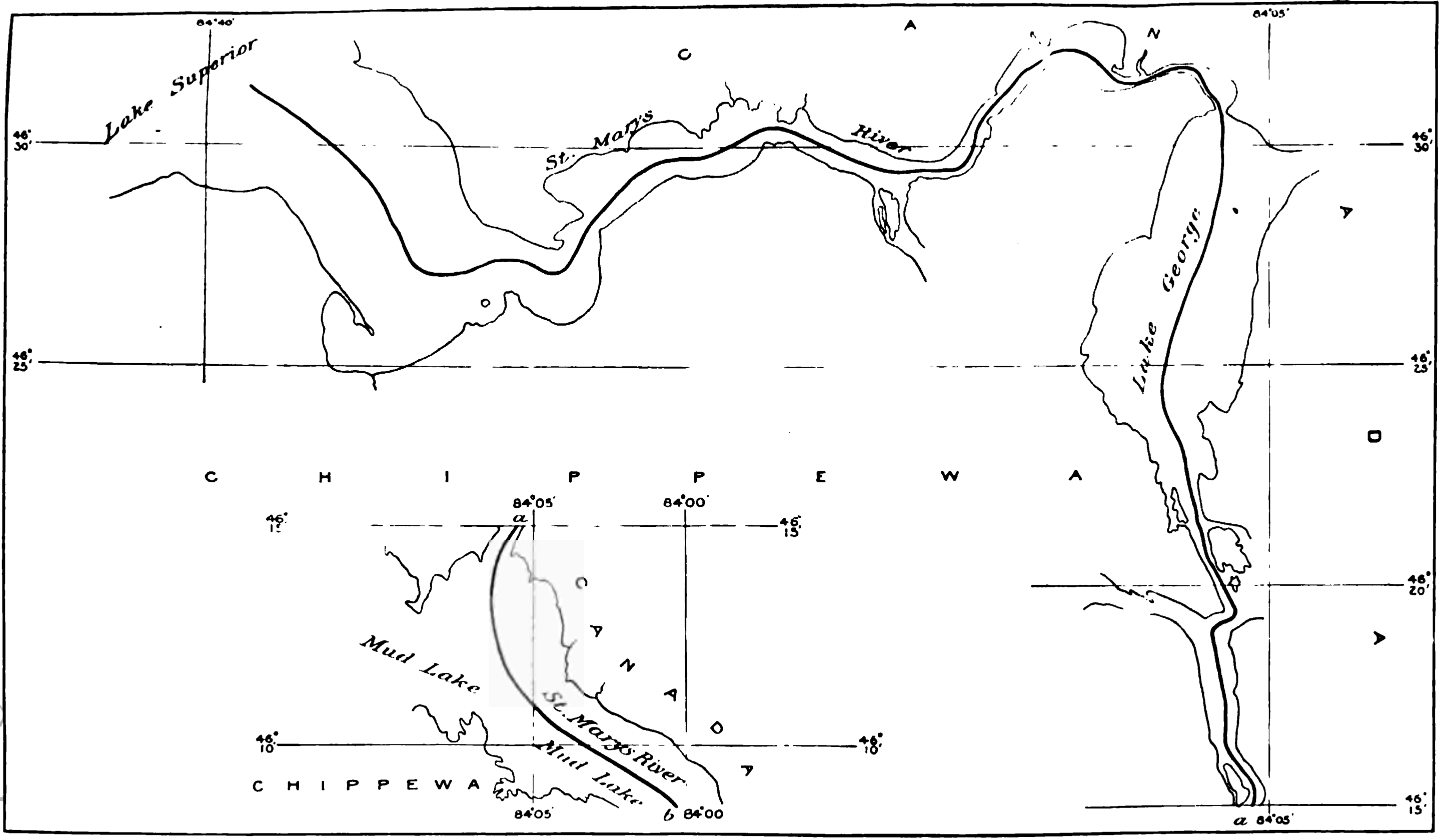
The case having reached that stage at which it became necessary to refer the points of difference to a friendly sovereign or state, the two powers found it expedient to regulate the proceedings and make provisions in relation to such reference, and on the 29th September, 1827, concluded a convention to that effect.



BOUNDARY BETWEEN UNITED STATES AND CANADA IN ST. CLAIR AND DETROIT RIVERS.



BOUNDARY BETWEEN MICHIGAN AND CANADA THROUGH ST. MARYS RIVER.



BOUNDARY BETWEEN MICHIGAN AND CANADA THROUGH ST. MARYS RIVER.

The respective claims of the United States and Great Britain were as follows, viz:

Boundary claimed by United States.—From the source of the river St. Croix (a point of departure mutually acknowledged) the boundary should be a due north line for about 140 miles, crossing the river St. John at about 75 miles. At about 97 miles it reaches a ridge or highland which divides tributary streams of the river St. John, which falls into the Bay of Fundy, from the waters of the river Ristigouche, which falls through the Bay des Chaleurs into the Gulf of St. Lawrence. In its further course the said due north line, after crossing several upper branches of the river Ristigouche, reaches, at about 140 miles, the highlands which divide the waters of the said river Ristigouche from the tributary streams of the river Metis, which falls into the river St. Lawrence.

Thence the line should run westerly and southwesterly along the highlands which divide the sources of the several rivers (from the Metis to the St. Francis) that empty themselves into the river St. Lawrence—from the sources of the tributaries of the rivers Ristigouche, St. John, Penobscot, Kennebec, and Connecticut, all which either mediately or immediately fall into the Atlantic Ocean.

Boundary claimed by Great Britain.—From the source of the river St. Croix the boundary should be a due north line about 40 miles to a point at or near Mars Hill; thence it should run westerly about 115 miles along the highlands that divide the sources of the tributaries of the river St. John from the sources of the river Penobscot to a spot called Metjarmette Portage, near the source of the river Chaudière.

From this point the line coincides with the line claimed by the United States until the northwesternmost head of the Connecticut River is reached. Great Britain claimed one of several small streams to be the northwesternmost tributary of the Connecticut River, and the United States another.

ARBITRATION BY KING OF THE NETHERLANDS.

The King of the Netherlands was selected in 1829 by the two Governments as the arbiter, and each laid before him, in conformity with the provisions of the convention, all the evidence intended to be brought in support of its claim, and two separate statements of the respective cases. These four statements, which embrace the arguments at large of each party, respectively, have been printed, but not published (1840).

The award of the King of the Netherlands, made in 1831, was as follows, viz:

* * * * * * *

We are of the opinion that it will be suitable (*il conviendra*) to adopt as the boundary of the two states a line drawn due north from the source of the river St. Croix to the point where it intersects the middle of the thalweg of the river St. John; thence the middle of the thalweg of that river, ascending it to the point where the river St. Francis empties itself into the river St. John; thence the middle of the thalweg of the river Saint Francis, ascending it to the source of its southwesternmost branch, which source we indicate on the Map A by the letter X, authenticated by the signature of our minister of foreign affairs; thence in a line drawn due west to the point where it unites with the line claimed by the United States of America and delineated on the Map A; thence said line to the point at which, according to said map, it coincides with that claimed by Great Britain, and thence the line traced on the map by the two powers to the northwesternmost source of Connecticut River.

* * * * * * *

We are of the opinion that the stream situated farthest to the northwest, among these which fall into the northernmost of the three lakes, the last of which bears the name of Connecticut Lake, must be considered as the northwesternmost head of Connecticut River.

* * * * * * *

We are of the opinion that it will be suitable (*il conviendra*) to proceed to fresh operations to measure the observed latitude in order to mark out the boundary from river Connecticut along the parallel of the forty-fifth degree of north latitude to the river Saint Lawrence, named in the treaties Iroquois or Cataraquy, in such a manner, however, that, in all cases, at the place called Rouse's Point the territory of the United States of America shall extend to the fort erected at that place, and shall include said fort and its kilometrical radius (*rayon kilometrique*).

* * * * * * *

However disposed the Government of the United States might have been to acquiesce in the decision of the arbiter, it had not the power to change the boundaries of a State without the consent of the State. Against that alteration the State of Maine entered a solemn protest by the resolutions of 19th January, 1832. And the Senate of the United States did accordingly refuse to give its assent to the award.

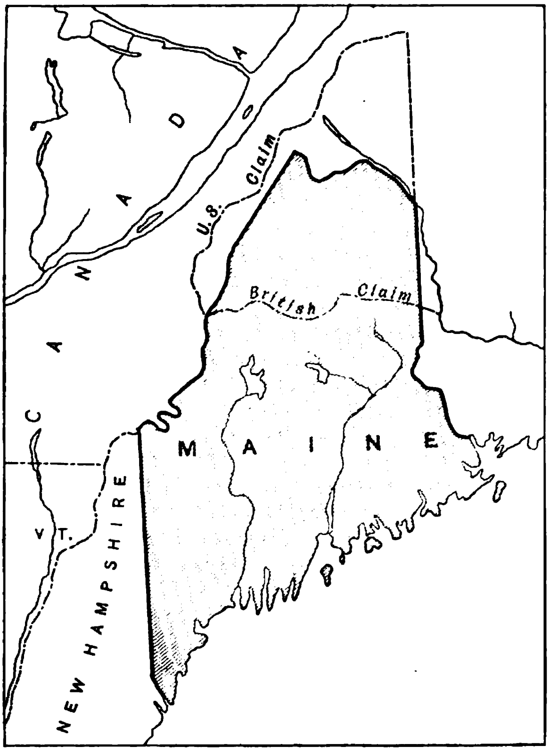
The arbitration of the King of the Netherlands having failed, fruitless negotiations ensued for a period of eleven years. Unsuccessful attempts were made to conclude an agreement preparatory to another arbitration. The subject became a matter of great irritation, collisions occurred in the contested territory, and for a time it seemed certain that the controversy would result in war between the two powers. In 1842, however, Great Britain gave unequivocal proof of her desire for the preservation of peace, and an amicable arrangement of the matter at issue, by the special mission of Lord Ashburton to the United States. The subject of this mission was the settlement, not only of the northeastern boundary, but the northern boundary west of the Rocky Mountains. Regarding this object of his mission, Lord Ashburton's instructions gave as the ultimatum of the English Government the boundary as above claimed (p. 16), and, naturally, his mission had no result, as far as this portion of the boundary was concerned.

An agreement was reached, however, in regard to the northeastern boundary, which, the consent of the State of Maine having been obtained, was embodied in the treaty concluded August 9, 1842.

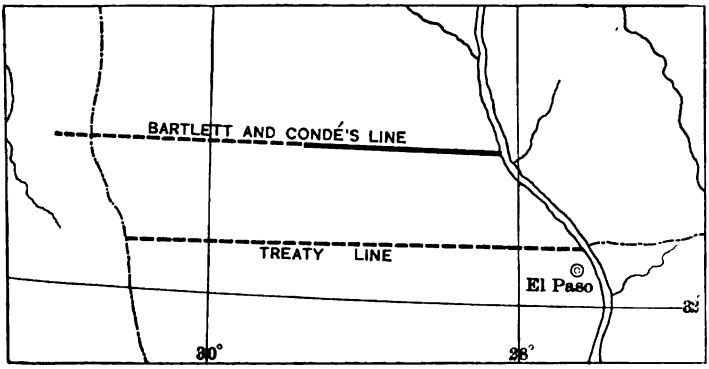
TREATY WITH GREAT BRITAIN, 1842.

The following is the text of the portion of this treaty relating to the boundary:

ARTICLE I. It is hereby agreed and declared that the line of boundary shall be as follows: Beginning at the monument at the source of the river St. Croix, as desig-



NORTHERN BOUNDARY OF MAINE, SHOWING UNITED STATES AND BRITISH CLAIMS.



PORTION OF DISTURNELL'S MAP OF SOUTHWESTERN BOUNDARY, 1847 (SEE PAGES 25-26).

nated and agreed to by the commissioners under the fifth article of the treaty of 1794, between the Governments of the United States and Great Britain; thence north, following the exploring line run and marked by the surveyors of the two Governments in the years 1817 and 1818, under the fifth article of the treaty of Ghent, to its intersection with the river St. John, and to the middle of the channel thereof; thence up the middle of the main channel of the said river St. John, to the mouth of the river Saint Francis; thence up the middle of the channel of the said river St. Francis, and of the lakes through which it flows, to the outlet of the Lake Pohenagamook; thence southwesterly, in a straight line, to a point on the northwest branch of the river St. John, which point shall be ten miles distant from the main branch of the St. John, in a straight line, and in the nearest direction, but if the said point shall be found to be less than seven miles from the nearest point of the summit or crest of the highlands that divide those rivers which empty themselves into the river St. Lawrence from those which fall into the river St. John, there the said point shall be made to recede down the said northwest branch of the river St. John, to a point seven miles in a straight line from the said summit or crest; thence in a straight line, in a course about south, eight degrees west, to the point where the parallel of latitude 46° 25′ north intersects the southwest branch of the St. John's; thence southerly, by the said branch, to the source thereof in the highlands at the Metjarmette portage; thence down along the said highlands which divide the waters which empty themselves into the river Saint Lawrence from those which fall into the Atlantic Ocean, to the head of Hall's stream; thence down the middle of said stream till the line thus run intersects the old line of boundary surveyed and marked by Valentine and Collins, previously to the year 1774, as the 45th degree of north latitude, and which has been known and understood to be the line of actual division between the States of New York and Vermont on one side, and the British province of Canada on the other; and from said point of intersection, west, along the said dividing line, as heretofore known and understood, to the Iroquois or St. Lawrence River.

ARTICLE II. It is moreover agreed that, from the place where the joint commissioners terminated their labors under the sixth article of the treaty of Ghent, to-wit, at a point in the Neebish channel, near Muddy Lake, the line shall run into and along the ship channel, between St. Joseph and Saint Tammany islands, to the division of the channel at or near the head of St. Joseph's Island; thence turning eastwardly and northwardly around the lower end of St. George's or Sugar Island, and following the middle of the channel which divides St. George's from St. Joseph's Island; thence up the east Neebish channel, nearest to St. George's Island, through the middle of Lake George; thence west of Jonas' Island, into St. Mary's River, to a point in the middle of that river, about one mile above St. George's or Sugar Island, so as to appropriate and assign the said island to the United States; thence, adopting the line traced on the maps by the commissioners, through the river St. Mary and Lake Superior, to a point north of Ile Royale, in said lake, one hundred yards to the north and east of Ile Chapeau, which last mentioned island lies near the northeastern point of Ile Royale, where the line marked by the commissioners terminates; and from the last-mentioned point, southwesterly, through the middle of the sound between Ile Royale and the northwestern mainland, to the mouth of Pigeon River, and up the said river, to and through the north and south Fowl Lakes, to the lakes of the height of land between Lake Superior and the Lake of the Woods; thence along the water communication to Lake Saisaginaga, and through that lake; thence to and through Cypress Lake, Lac du Bois Blanc, Lac la Croix, Little Vermillion Lake, and Lake Namecan, and through the several smaller lakes, straits, or streams, connecting the lakes here mentioned, to that point in Lac la Pluie, or Rainy Lake, at the Chaudière Falls, from which the commissioners traced the line to the most northwestern point of the Lake of the Woods; thence, along the said line, to the said most northwestern point, being in latitude 49° 23′ 55″ north, and in longitude 95° 14′ 38″ west from the observatory at Greenwich; thence, according to existing treaties, due south to its intersection with the forty-ninth parallel of north latitude, and along that parallel to the Rocky Mountains. It being understood that all the water communications and all the usual portages along the line from Lake Superior to the Lake of the Woods, and also Grand Portage, from the shore of Lake Superior to the Pigeon River, as now actually used, shall be free and open to the use of the citizens and subjects of both countries.

* * * * * * *

ARTICLE VII. It is further agreed that the channels in the river St. Lawrence, on both sides of the Long Sault islands, and of Barnhart Island; the channels in the river Detroit, on both sides of the island Bois Blanc, and between that island and both the American and Canadian shores, and all the several channels and passages between the various islands lying near the junction of the river St. Clair with the lake of that name, shall be equally free and open to the ships, vessels, and boats of both parties.

Between 1843 and 1846 there was considerable negotiation regarding the boundary west of the Rocky Mountains, resulting finally in the Webster-Ashburton treaty, which defined the boundary as far west as the straits of Juan de Fuca. The following is that portion of the treaty which defines the boundary.

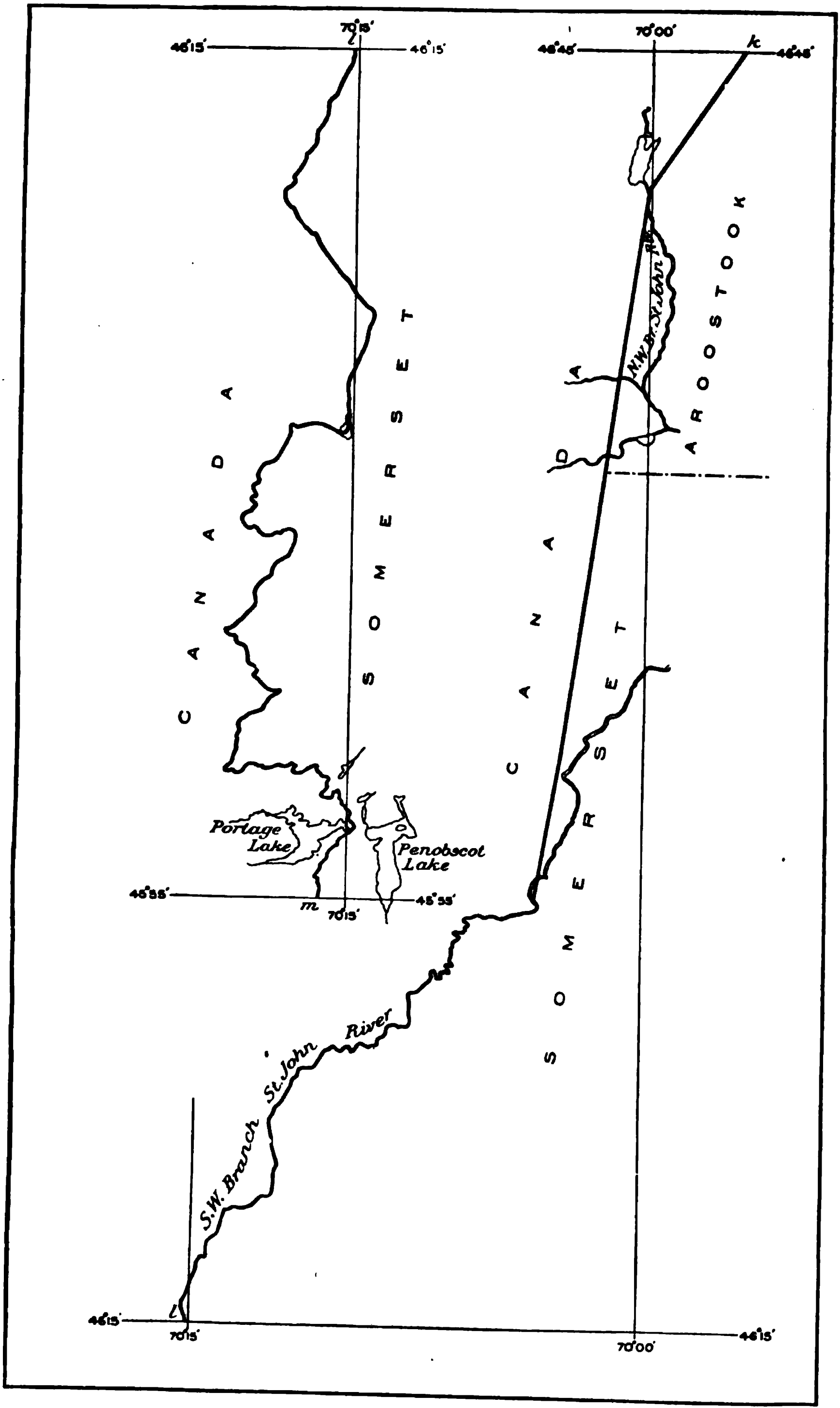
WEBSTER-ASHBURTON TREATY WITH GREAT BRITAIN, 1846.

ARTICLE I. From the point on the forty-ninth parallel of north latitude, where the boundary laid down in existing treaties and conventions between the United States and Great Britain terminates, the line of boundary between the territories of the United States and those of Her Britannic Majesty shall be continued westward along the said forty-ninth parallel of north latitude to the middle of the channel which separates the continent from Vancouver's Island, and thence southerly through the middle of the said channel, and of Fuca's Straits to the Pacific Ocean: *Provided, however*, That the navigation of the whole of the said channel and straits south of the forty-ninth parallel of north latitude remain free and open to both parties.

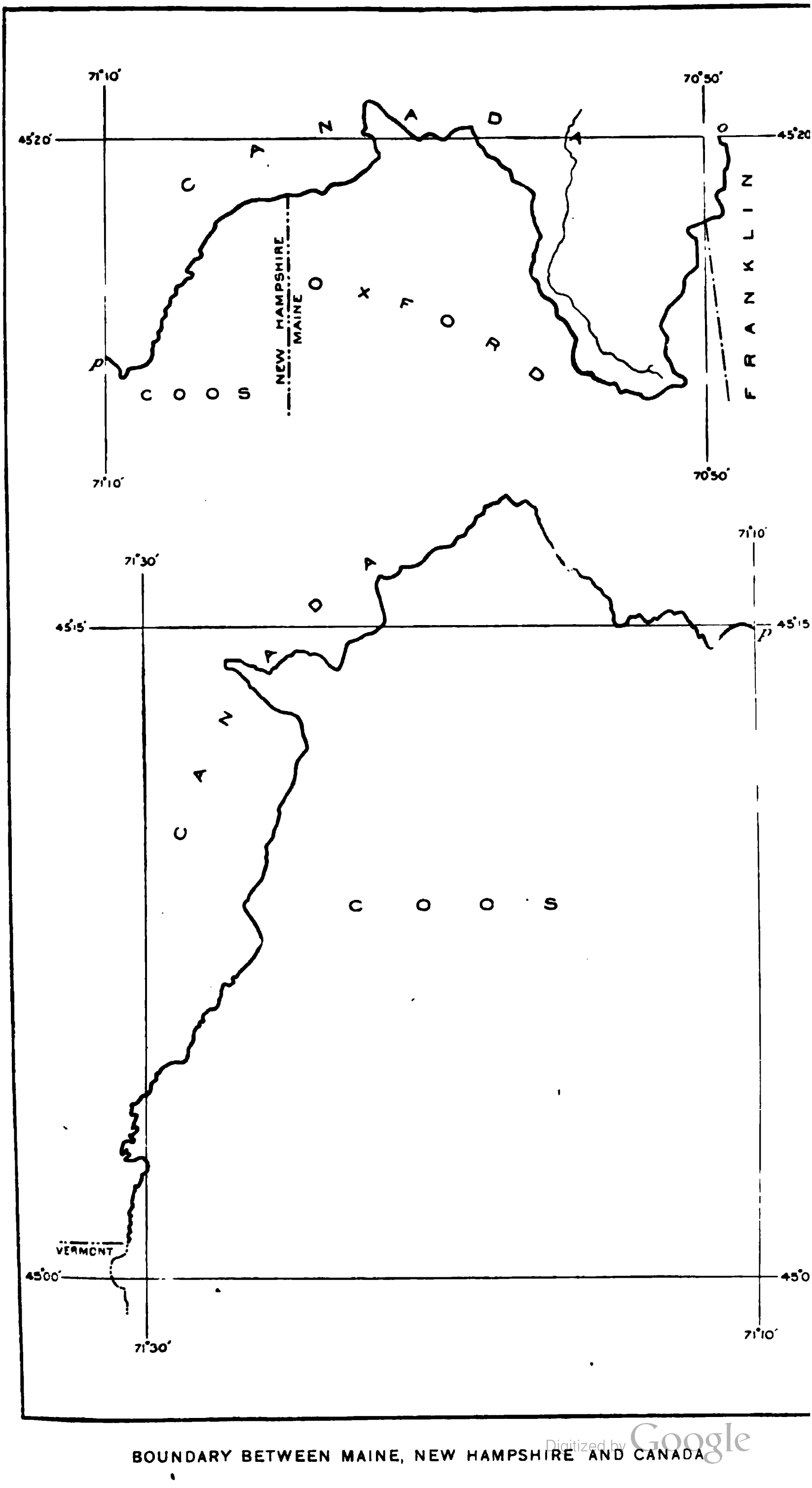
ARTICLE II. From the point at which the forty-ninth parallel of north latitude shall be found to intersect the great northern branch of the Columbia River, the navigation of the said branch shall be free and open to the Hudson's Bay Company, and to all British subjects trading with the same, to the point where the said branch meets the main stream of the Columbia, and thence down the said main stream to the ocean, with free access into and through the said river or rivers, it being understood that all the usual portages along the line thus described shall, in like manner, be free and open. In navigating the said river, or rivers, British subjects, with their goods and produce, shall be treated on the same footing as citizens of the United States; it being, however, always understood that nothing in this article shall be construed as preventing, or intending to prevent, the Government of the United States from making any regulations respecting the navigation of the said river or rivers not inconsistent with the present treaty.

The above treaty extended the line westward from the Rocky Mountains to the Pacific along the forty-ninth parallel of latitude. This settled the northern boundary with the exception of the islands and passages in the straits of Georgia and of Juan de Fuca, the English claiming that the boundary should properly run through the Rosario strait, the most eastern passage, while the United States claimed that it should naturally follow the Strait of Haro.

This matter was finally settled by a reference to the Emperor of Germany as an arbitrator, who decided it in favor of the United States on



BOUNDARY BETWEEN MAINE AND CANADA.



BOUNDARY BETWEEN MAINE, NEW HAMPSHIRE AND CANADA

the 21st of October, 1872, thus finally disposing of our boundary with Great Britain.

ADDITIONS TO THE TERRITORY OF THE UNITED STATES.

LOUISIANA PURCHASE.

The entire basin of the Mississippi, with much of the coast region of the Gulf of Mexico, which was subsequently known as the territory of Louisiana, was originally claimed by France by virtue of discovery and occupation.

In 1712 France made a grant to Antoine de Crozat, of the exclusive right to the trade of this region. As this grant makes the first, and indeed, the only, statement of the limits of this vast region, as they were understood by France, a portion of it is here introduced.

> We have by these presents signed with our hand, authorized, and do authorize the said Sieur Crozat to carry on exclusively the trade in all the territories by us possessed, and bounded by New Mexico and by those of the English in Carolina, all the establishments, ports, harbors, rivers, and especially the port and harbor of Dauphin Island, formerly called Massacre Island, the river St. Louis, formerly called the Mississippi, from the seashore to the Illinois, together with the river St. Philip, formerly called the Missouries River, and the St. Jerome, formerly called the Wabash (the Ohio), with all the countries, territories, lakes in the land, and the rivers emptying directly or indirectly into that part of the river St. Louis. All the said territories, countries, rivers, streams, and islands we will to be and remain comprised under the name of the government of Louisiana, which shall be dependent on the General Government of New France and remain subordinate to it, and we will, moreover, that all the territories which we possess on this side of the Illinois be united, as far as need be, to the General Government of New France and form a part thereof, reserving to ourself, nevertheless, to increase, if we judge proper, the extent of the government of the said country of Louisiana.

From this it appears that Louisiana was regarded by France as comprising the drainage basin of the Mississippi at least as far north as the mouth of the Illinois, with those of all its branches which enter it below this point, including the Missouri, but excluding that portion in the Southwest claimed by Spain. It is, moreover, certain that the area now comprised in Washington, Oregon, and Idaho was not included.

Crozat surrendered this grant in 1717.

On November 3, 1762, France ceded this region to Spain, defining it only as the province of Louisiana. A few months later, on February 10, 1763, by the treaty of peace between Great Britain, France, and Spain, the western boundary of the former's possessions in the New World was placed in the center of the Mississippi River, thus reducing the area of Louisiana by the portion east of the Mississippi River. Thus by these two treaties France disposed of her possessions in North America, dividing them between Great Britain and Spain. The limit set between their possessions was given as the Mississippi, the river Iberville, and lakes Maurepas and Pontchartrain.

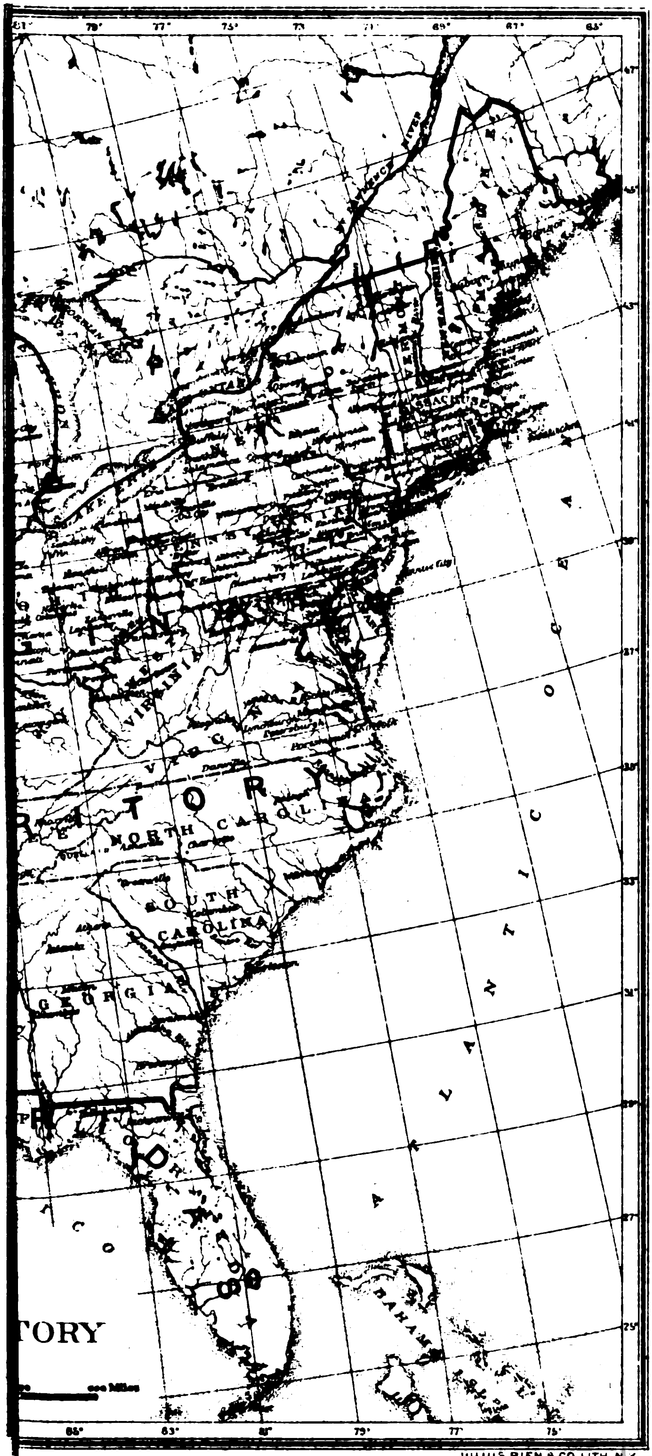
Great Britain then proceeded to subdivide her share of this territory. The area south of a meridian through the mouth of Yazoo River and west of Apalachicola River she called West Florida; the region east thereof and south of the present north boundary of Florida received the name of East Florida. For the following twenty years, i. e., up to 1783, these boundaries and names remained undisturbed. In the latter year, by the treaty of peace with the United States at the close of the Revolution, Great Britain reduced the area of West Florida by the cession of that portion north of the thirty-first parallel to the United States. In the same year she gave East Florida and what remained of West Florida to Spain, and in Spain's possession they remained until ceded to the United States in 1819.

Meantime, in 1800, by the secret treaty of San Ildefonso, Spain promised to return Louisiana to France. In the language of the treaty, she pledged herself to return to France the "Province of Louisiana, with the same extent it now has in the hands of Spain, and that it had when Spain possessed it, and such as it should be after the treaties subsequently entered into between Spain and other States."

Immediately after this transfer became known, on November 30, 1802, measures were set on foot by President Jefferson for securing in some way free access to the sea by way of the Mississippi River. Circumstances favored this negotiation. Bonaparte was at that time in almost daily expectation of a declaration of war by Great Britain, in which case the first act of the latter would be to seize the mouth of the Mississippi, and with it the province of Louisiana. Under these circumstances Bonaparte offered to sell the province to the United States, and the offer was promptly accepted. The consideration was 60,000,000 francs and the assumption by the United States of the "French spoliation claims," which were estimated to amount to $3,750,000.

The treaty of cession, which bears date April 30, 1803, describes the territory only as being the same as ceded by Spain to France by the treaty of San Ildefonso.

From this it appears that the territory sold to the United States comprised that part of the drainage basin of the Mississippi which lies west of the course of the river, with the exception of such parts as were then held by Spain. The want of precise definition of limits in the treaty was not objected to by the American commissioners, as they probably foresaw that this very indefiniteness might prove of service to the United States in future negotiations with other powers. In fact, the claim of the United States to the area now comprised in Oregon, Washington, and Idaho in the negotiations with Great Britain regarding the northwestern boundary, was ostensibly based, not only upon prior occupation and upon purchase from Spain, but also upon the alleged fact that this area formed part of the Louisiana purchase. That this claim was baseless is shown not only by what has been already detailed regarding the limits of the purchase, but also by the



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direct testimony of the French plenipotentiary, M. Barbé Marbois. Some twenty years after the purchase he published a work upon Louisiana, in which he detailed at some length the negotiations which preceded the purchase, and, referring to this question said: "The shores of the western ocean were certainly not comprised in the cession, but already the United States are established there."

There is also contained in this work a map of the country between the Mississippi and the Pacific, on which the extent of Louisiana to the westward is indicated by a line drawn on the one hundred and tenth meridian, which is not far from the western limit of the drainage basin of the Mississippi in Wyoming and Montana. That part of the country now comprised in Oregon, Washington, and Idaho, which, it has been claimed, formed part of the purchase, bears the following legend: "Territories and countries occupied by the United States, following the treaty of cession of Louisiana."

From this it appears that the northwestern limits of the Louisiana purchase can no longer be a matter of discussion; but although the United States certainly did not purchase Oregon, as a part of Louisiana, it is no less certain that that great area west of the Rocky Mountains fell into their hands as a direct consequence of such purchase.

FLORIDA PURCHASE.

The second addition to the territory of the United States consisted of the Floridas, purchased from Spain on February 22, 1819. From the date of the Louisiana purchase, in 1803, the territory bounded by the Mississippi River on the west, the Perdido on the east, the parallel of 31° on the north, and the Gulf on the south had been in dispute between the two countries. During a part of this time it had been practically in the possession of the United States.

The clause quoted above from the treaty of San Ildefonso was interpreted by Jefferson and others in this country to mean the inclusion of West Florida. Their reasoning was this: In 1800 Spain owned West Florida; West Florida was once a part of Louisiana; in 1800 Spain re-ceded Louisiana to France; she therefore re-ceded West Florida with it.

Spain, however, held that this was merely a treaty of recession, by which she gave back to France what France had given to her in 1762. Since in 1762 she did not own West Florida, she could not, therefore, have re-ceded it to France.

As to this matter, Marbois, the French plenipotentiary, was very positive in stating that West Florida formed no part of the Louisiana purchase, and that the southeastern boundary of the latter was the river Iberville and lakes Maurepas and Pontchartrain.

Immediately after the Louisiana purchase the claim was made by the United States that it included most of West Florida, and also a part of the Texas coast, but this was not entertained by Spain. In 1810 a revolution was effected in that part of West Florida lying west of Pearl River, and application was made for annexation to the United States. The governor of Louisiana, under instructions from Washington, at once took possession, but immediately a counter revolution was organized against him, which was put down by force of arms, and in 1812 this part of West Florida was annexed to the State of Louisiana. Meantime, the insurrection spread eastward in West Florida, and, although put down by Spanish authorities, the movement received the sympathy of the United States, which passed a secret act authorizing the President, under certain specified contingencies, to use force in taking possession of the Floridas. In 1812 that portion of West Florida lying between Perdido and Pearl rivers was annexed to the Territory of Mississippi.

This purchase settled these conflicting claims.

The following is the clause in the treaty with Spain ceding the Floridas which defines the cession:

> ART. 2. His Catholic Majesty cedes to the United States, in full property and sovereignty, all the territories which belong to him, situated to the eastward of the Mississippi, known by the name of East and West Florida, the adjacent islands dependent upon said province, etc.

A further article in this treaty defines the boundary between the United States and the Spanish possessions in the Southwest, as follows:

> The boundary line between the two countries, west of the Mississippi, shall begin on the Gulf of Mexico, at the mouth of the river Sabine, in the sea, continuing north, along the western bank of that river, to the thirty-second degree of latitude, thence by a line due north to the degree of latitude where it strikes the Rio Roxo of Nachitoches, or Red River; then following the course of the Rio Roxo to the degree of longitude 100 west from London, or about 23° west of Washington; then crossing the said Rio Roxo and running thence, by a line due north, to the River Arkansas; thence, following the course of the southern bank of the Arkansas, to its source in latitude 42 north; and thence by that parallel of latitude to the South Sea, the whole being as laid down in Melish's map of the United States, published at Philadelphia, improved to the 1st of January, 1818. But if the source of the Arkansas River shall be found to fall north or south of latitude 42, then the line shall run from the said source due south or north, as the case may be, till it meets the said parallel of latitude 42, and thence along the said parallel to the South Sea, all the islands in the Sabine and the said Red and Arkansas rivers, throughout the course thus described, to belong to the United States; but the use of the waters, and the navigation of the Sabine to the sea, and of the said rivers Roxo and Arkansas throughout the extent of the said boundary on their respective banks shall be common to the respective inhabitants of both nations.

TEXAS ACCESSION.

The next acquisition of territory was that of the Republic of Texas, which was admitted as a State on December 29, 1845. The area which Texas brought into the Union was limited as follows, as defined by the Republic of Texas, December 19, 1836:

> Beginning at the mouth of the Sabine River and running west along the Gulf of Mexico three leagues from land to the mouth of the Rio Grande, thence up the principal stream of that river to its source, thence due north to the forty-second degree of north latitude, thence along the boundary line as defined in the treaty between Spain and the United States, to the beginning.

FIRST MEXICAN CESSION.

In 1848 a further addition was made to our territory by the treaty of Guadalupe-Hidalgo. This added to the country the area of California, Nevada, Utah, and parts of Colorado, Arizona, and New Mexico, while the Gadsden purchase, which was effected in 1853, added the remainder of Arizona and another part of New Mexico.

The treaty of Guadalupe-Hidalgo was concluded February 2, 1848, and proclaimed July 4, 1848. The clauses in it defining our acquisition of territory are as follows:

> ARTICLE V. The boundary line between the two Republics shall commence in the Gulf of Mexico, three leagues from land, opposite the mouth of the Rio Grande, otherwise called the Rio Bravo del Norte, or opposite the mouth of its deepest branch, if it should have more than one branch emptying into the sea; from thence up the middle of that river, following the deepest channel where it has more than one, to the point where it strikes the southern boundary of New Mexico; thence westwardly along the whole southern boundary of New Mexico (which runs north of the town called Paso) to its western termination; thence northward along the western line of New Mexico until it intersects the first branch of the river Gila (or if it should not intersect any branch of that river, then to the point on the said line nearest to such branch, and thence in a direct line to the same); thence down the middle of the said branch and of the said river until it empties into the Rio Colorado; thence across the Rio Colorado, following the division line between Upper and Lower California, to the Pacific Ocean.
>
> The southern and western limits of New Mexico, mentioned in this article, are those laid down in the map entitled, "Map of the United Mexican States as organized and defined by various acts of the Congress of said Republic, and constructed according to the best authorities. Revised edition. Published at New York, in 1847, by J. Disturnell;" of which map a copy is added to this treaty, bearing the signatures and seals of the undersigned plenipotentiaries. And in order to preclude all difficulty in tracing upon the ground the limit separating Upper from Lower California, it is agreed that the said limit shall consist of a straight line drawn from the middle of the Rio Gila, where it unites with the Colorado, to a point on the coast of the Pacific Ocean, distant one marine league due south of the southernmost point of the port of San Diego, according to the plan of said port made in the year 1782, by Don Juan Pantoja, second sailing master of the Spanish fleet, and published at Madrid in the year 1802, in the atlas to the voyage of the schooners Sutil and Mexicana; of which plan a copy is hereunto added, signed, and sealed by the respective plenipotentiaries.

Much difficulty followed in the interpretation of this treaty. A joint commission of the two Governments was formed, consisting of a commissioner and a chief surveyor from each. They were instructed that any decision upon the interpretation of the treaty must be agreed to unanimously. The most important question coming before the commission for decision concerned the location and extent of the south boundary of New Mexico. Here, unfortunately, the Disturnell map left room for broad difference in opinion. The town called Paso is incorrectly located upon the map to the extent of nearly half a degree of latitude, or, in other words, the parallels of latitude are misplaced to this extent, so that if the position of the south boundary of New Mexico be accepted with reference to the nearest parallel of latitude, it is half a degree farther north than it would be if its position were measured from the town of Paso.

In the absence of the chief surveyor the other three members of the commission, including Mr. J. R. Bartlett, United States commissioner, agreed to accept the position of the south boundary of New Mexico as shown by the projection lines of the map; to run a line in this latitude 3 degrees west from the Rio Grande, and from the end of this line to run north until a branch of Gila River was intersected. In accordance with this decision a durable monument was erected on the bank of the Rio Grande, in latitude 32° 22′, and the line was run a degree and a half to the westward. At this time the chief surveyor arrived, learned what had been done, and made a vigorous protest against this interpretation of the map. This protest, backed by Major Emory, the chief astronomer, caused a sudden stoppage of the work of running the line and the repudiation of the agreement by the United States Government. Negotiations followed, but no agreement was reached until in 1853 the whole matter was taken out of court by the Gadsden purchase.

GADSDEN PURCHASE.

Subsequently, on December 30, 1853, a second purchase was made of Mexico, consisting of the strip of land lying south of the Gila River, in New Mexico and Arizona. The boundaries as established by this, known as the Gadsden purchase, were as follows:

> ARTICLE I. The Mexican Republic agrees to designate the following as her true limits with the United States for the future: Retaining the same dividing line between the two Californias as already defined and established, according to the fifth article of the treaty of Guadalupe-Hidalgo, the limits between the two Republics shall be as follows: Beginning in the Gulf of Mexico, three leagues from land, opposite the mouth of the Rio Grande, as provided in the fifth article of the treaty of Guadalupe-Hidalgo; thence, as defined in the said article, up the middle of that river to the point where the parallel of 31° 47′ north latitude crosses the same; thence due west one hundred miles; thence south to the parallel of 31° 20′ north latitude; thence along the said parallel of 31° 20′ to the one hundred and eleventh meridian of longitude west of Greenwich; thence in a straight line to a point on the Colorado River twenty English miles below the junction of the Gila and Colorado rivers; thence up the middle of the said river Colorado until it intersects the present line between the United States and Mexico.

In the year following a commission was appointed for surveying and marking this line, under the United States commissioner, Maj. W. H. Emory. The line was run and marked in the year 1855, and the report was transmitted in the following year.

As settlement increased in the territory which this line traverses the fact was developed that the line was insufficiently marked. Some of the monuments had disappeared and in many places there were great extents of country in which no monuments had ever been placed, so that the necessity became apparent for rerunning and marking of the line. For this purpose a commission was created in 1891, the United States members of which were Col. J. W. Barlow and Capt. D. D. Gaillard, Corps of Engineers, U. S. A., and Mr. A. T. Mosman of the United States Coast and Geodetic Survey. Under this commission the line was recovered from the original monuments as far as possible, and between these monuments was rerun and fully and durably marked. The report, with maps, profiles, and illustrations of the monuments, was published in 1899.

ALASKA PURCHASE.

Alaska was purchased from Russia, the treaty of purchase having been signed on March 30, 1867, and proclaimed June 20, 1867. The boundaries of the territory are described in the accompanying quotation from the treaty:

> Commencing from the southernmost point of the island called Prince of Wales Island, which point lies in the parallel of 54° 40″ north latitude, and between the one hundred and thirty-first and one hundred and thirty-third degree of west longitude (meridian of Greenwich), the said line shall ascend to the north along the channel called Portland Channel as far as the point of the continent where it strikes the fifty-sixth degree of north latitude; from this last-mentioned point the line of demarkation shall follow the summit of the mountains situated parallel to the coast as far as the point of intersection of the one hundred and forty-first degree of west longitude (of the same meridian); and, finally, from the said point of intersection the said meridian line of the one hundred and forty-first degree in its prolongation as far as the Frozen Ocean.
>
> IV. With reference to the line of demarkation laid down in the preceding article it is understood—
>
> 1st. That the island called Prince of Wales Island shall belong wholly to Russia (now, by this cession, to the United States).
>
> 2d. That whenever the summit of the mountains which extend in a direction parallel to the coast from the fifty-sixth degree of north latitude to the point of intersection of the one hundred and forty-first degree of west longitude shall prove to be at the distance of more than ten marine leagues from the ocean, the limit between the British possessions and the line of coast which is to belong to Russia, as above mentioned (that is to say, the limit to the possessions ceded by this convention), shall be formed by a line parallel to the winding of the coast, and which shall never exceed the distance of ten marine leagues therefrom.
>
> The western limit within which the territories and dominion conveyed are contained passes through a point in Behring's Straits on the parallel of 65° 30′ north latitude at its intersection by the meridian which passes midway between the islands of Krusenstern or Ignalook and the island of Ratmanoff or Noonerbook, and proceeds due north without limitation into the same Frozen Ocean.
>
> The same western limit, beginning at the same initial point, proceeds thence in a course nearly southwest through Behring's Straits and Behring's Sea, so as to pass midway between the northwest point of the island of Saint Lawrence and the southeast point of Cape Choukotski to the meridian of one hundred and seventy-two west longitude; thence from the intersection of that meridian in a southwesterly direction, so as to pass midway between the island of Attore and the Copper Island of the Kormandorski couplet or group, in the North Pacific Ocean, to the meridian of one hundred and ninety-three degrees west longitude, so as to include in the territory conveyed the whole of the Aleutian Islands west of that meridian.

The consideration paid for Alaska was $7,200,000 in gold.

There is no possibility of a misinterpretation of the language of the above treaty concerning the portion of the boundary running along the one hundred and forty-first meridian from the shores of the Arctic Ocean to the neighborhood of the coast near Mount St. Elias, and in recent years points upon this boundary, notably at the crossing of the Yukon, have been established by the United States and Canadian surveyors by astronomic means and marked.

Concerning the remaining portion of the boundary, however, from the neighborhood of Mount St. Elias southeastward to the mouth of Portland Canal, question has been raised in recent years by Canadian authorities.

It has long been known that the coast of this part of Alaska is extremely broken, containing many fiords extending far inland, and that no continuous range of mountains parallels the coast. It was for many years tacitly admitted by both sides that the second alternative of the treaty, that the boundary should follow a line 10 marine leagues distant from the coast and following its windings, should be the one finally adopted when the question of marking the boundary arose. This position was taken by the United States and consistently followed from the time of the acquisition of the territory to the present. All maps, United States and Canadian, agreed on it. Many acts of sovereignty were performed by the United States within this territory, no question being raised by the Canadian authorities, and the claim of the United States to a strip of territory 10 marine leagues in width from the main coast was universally admitted by the Canadian authorities. The discovery of gold in the basin of the Yukon, in Canada, and the fact that the only feasible means of access to this region lay through United States territory, made it extremely desirable for Canada to possess a port or ports on this coast as the starting points of routes to the Yukon mines, and it was only when this necessity appeared that any question arose concerning the interpretation of the definition of limits in the treaty.

The claim made by the British Government, before a joint commission on the boundary, on behalf of Canada, in August, 1898, was that this portion of the boundary, instead of passing up Portland Canal, should pass up Pearse Canal, connecting with Portland Canal, up which it follows to the summit of the mountains nearest to the coast, and then should follow them, regardless of the fact that they do not form a continuous range, crossing all the inlets of the sea up to Mount St. Elias. This, of course, was refused by the United States commissioners. A proposition made by the British commissioners to refer the matter to arbitration was also refused by the United States commissioners, on the ground that there was nothing to arbitrate, since the territory in question was in the possession of the United States, and had been for many years without dispute, such possession being in full accord with the terms of the treaty. The commission was then dissolved, the only outcome being an agreement that the summits of White and Chilkoot passes and a point upon the Chilkat, above Pyramid Harbor, were temporarily adopted as points upon the boundary.

HAWAIIAN ISLANDS.

The Republic of Hawaii, comprising eight islands in the Pacific, voluntarily joined the United States in 1898.

PORTO RICO, GUAM, AND PHILIPPINE ISLANDS.

The latest accession of territory made by the United States were the islands taken from Spain following the war of 1898. These were relinquished to the United States by the treaty of peace of December 10, 1898. They were as follows:

Cuba, sovereignty over which was relinquished by Spain and assumed by the United States. With Cuba was included the Isle of Pines and the islets scattered around the Cuban coast.

Porto Rico and other Spanish West India islands which were ceded to the United States.

The island of Guam, in the Ladrones.

The Philippine Islands, which comprise all the islands lying within the following line, as defined in the words of the treaty:

> A line running from west to east along or near the twentieth parallel of north latitude, and through the middle of the navigable channel of Bachi, from the one hundred and eighteenth (118th) to the one hundred and twenty-seventh (127th) degree meridian of longitude east of Greenwich; thence along the one hundred and twenty-seventh (127th) degree meridian of longitude east of Greenwich to the parallel of four degrees and forty-five minutes (4° 45′) north latitude; thence along the parallel of four degrees and forty-five minutes (4° 45′) north latitude to its intersection with the meridian of longitude one hundred and nineteen degrees and thirty-five minutes (119° 35′) east of Greenwich; thence along the meridian of longitude one hundred and nineteen degrees and thirty-five minutes (119° 35′) east of Greenwich to the parallel of latitude seven degrees and forty minutes (7° 40′) north; thence along the parallel of latitude seven degrees and forty minutes (7° 40′) north to its intersection with the one hundred and sixteenth (116th) degree meridian of longitude east of Greenwich; thence by a direct line to the intersection of the tenth (10th) degree parallel of north latitude with the one hundred and eighteenth (118th) degree meridian of longitude east of Greenwich; and thence along the one hundred and eighteenth (118th) degree meridian of longitude east of Greenwich to the point of beginning.

For the Philippines the sum of $20,000,000 was paid by the United States to Spain.

CHAPTER II.

THE PUBLIC DOMAIN AND AN OUTLINE OF THE HISTORY OF CHANGES MADE THEREIN.

CESSIONS BY THE STATES.

At the time the Constitution was adopted by the original thirteen States, many of them possessed unoccupied territory, in some cases entirely detached and lying west of the Appalachian Mountains. Thus, Georgia included the territory from its present eastern limits westward to the Mississippi River. North Carolina possessed a narrow strip extending from latitude 35° to 36° 30′, approximately, and running westward to the Mississippi, including besides its own present area that of the present state of Tennessee. In like manner, Virginia possessed what is now Kentucky, while a number of States, as Pennsylvania, New York, Massachusetts, and Connecticut, laid claim to areas in what was afterward known as the Territory Northwest of the River Ohio, a region which is now comprised mainly in the States of Ohio, Indiana, Illinois, Michigan, and Wisconsin. These claims were to a greater or less extent conflicting. In some cases several States claimed authority over the same area, while the boundary lines were in most cases very ill-defined.

The ownership of these western lands by individual States was opposed by those States which did not share in their possession, mainly on the ground that the resources of the General Government, to which all contributed, should not be taxed for the protection and development of this region, while its advantages would inure to the benefit of but a favored few. On this ground several of the States refused to ratify the Constitution until this matter had been settled by the cession of these tracts to the General Government.

Moved by these arguments, as well as by the consideration of the conflicting character of the claims, which must inevitably lead to trouble among the States, Congress passed, on October 30, 1779, the following act:

Whereas the appropriation of the vacant lands by the several States during the present war will, in the opinion of Congress, be attended with great mischiefs: Therefore,

Resolved, That it be earnestly recommended to the State of Virginia to reconsider their late act of assembly for opening their land office; and that it be recommended to the said State, and all other States similarly circumstanced, to forbear settling or issuing warrants for unappropriated lands, or granting the same during the continuance of the present war.

This resolution was transmitted to the different States. The first to respond to it by the transfer of her territory to the General Government was New York, whose example was followed by the other States.

These cessions were made on the dates given below:

New York, March 1, 1781.
Virginia, March 1, 1784.
Massachusetts, April 19, 1785
Connecticut, September 13, 1786.

The Connecticut act of cession reserved an area in the northeastern part of Ohio, known as the Western Reserve. On May 30, 1800, Connecticut gave to the United States jurisdiction over this area, but without giving up its property rights in it.

South Carolina, August 9, 1787.
North Carolina, February 25, 1790.
Georgia, April 24, 1802.

The following paragraph from the deed of cession by New York defines the limits of its cession to the General Government:

> Now, therefore, know ye, that we, the said James Duane, William Floid, and Alexander M'Dougall, by virtue of the power and authority, and in the execution of the trust reposed in us, as aforesaid, have judged it expedient to limit and restrict, and we do, by these presents, for and in behalf of the said State of New York, limit and restrict the boundaries of the said State in the western parts thereof, with respect to the jurisdiction, as well as the right or pre-emption of soil, by the lines and in the form following, that is to say: a line from the northeast corner of the State of Pennsylvania, along the north bounds thereof to its northwest corner, continued due west until it shall be intersected by a meridian line to be drawn from the forty-fifth degree of north latitude, through the most westerly bent or inclination of Lake Ontario; thence by the said meridian line to the forty-fifth degree of north latitude; and thence by the said forty-fifth degree of north latitude; but if, on experiment, the above-described meridian line shall not comprehend twenty miles due west from the most westerly bent or inclination of the river or strait of Niagara, then we do, by these presents, in the name of the people, and for and on behalf of the State of New York, and by virtue of the authority aforesaid, limit and restrict the boundaries of the said State in the western parts thereof, with respect to jurisdiction, as well as the right of pre-emption of soil, by the lines and in the manner following, that is to say: a line from the northeast corner of the State of Pennsylvania, along the north bounds thereof, to its northwest corner, continued due west until it shall be intersected by a meridian line, to be drawn from the forty-fifth degree of north latitude, through a point twenty miles due west from the most westerly bent or inclination of the river or strait Niagara; thence by the said meridian line to the forty-fifth degree of north latitude, and thence by the said forty-fifth degree of north latitude.

The deed of cession by Virginia gives no limits, further than to specify that the lands transferred include only those lying northwest of the river Ohio.

The following paragraph from the deed of cession by Massachusetts gives the limits of the area ceded:

> * * * We do by these presents assign, transfer, quitclaim, cede, and convey to the United States of America, for their benefit, Massachusetts inclusive, all right, title, and estate of and in, as well the soil as the jurisdiction, which the said Com-

monwealth hath to the territory or tract of country within the limits of Massachusetts charter situate and lying west of the following line, that is to say, a meridian line to be drawn from the forty-fifth degree of north latitude through the westerly bent or inclination of Lake Ontario, thence by the said meridian line to the most southerly side line of the territory contained in the Massachusetts charter; but if on experiment the above-described meridian line shall not comprehend twenty miles due west from the most westerly bent or inclination of the river or strait of Niagara, then we do by these presents, by virtue of the power and authority aforesaid, in the name and on behalf of the said Commonwealth of Massachusetts, transfer, quitclaim, cede, and convey to the United States of America, for their benefit, Massachusetts inclusive, all right, title, and estate of and in as well the soil as the jurisdiction, which the said Commonwealth hath to the territory or tract of country within the limits of the Massachusetts charter, situate and lying west of the following line, that is to say, a meridian line to be drawn from the forty-fifth degree of north latitude through a point twenty miles due west from the most westerly bent or inclination of the river or strait of Niagara; thence by the said meridian line to the most southerly side line of the territory contained in the Massachusetts charter aforesaid.

The following clause from the act of the legislature of Connecticut, authorizing the cession, defines its limits:

Be it enacted * * * That the delegates of this State, or any two of them, who shall be attending the Congress of the United States, be, and they are hereby, directed, authorized, and fully empowered, in the name and behalf of this State, to make, execute, and deliver, under their hands and seals, an ample deed of release and cession of all the right, title, interest, jurisdiction, and claim of the State of Connecticut to certain western lands, beginning at the completion of the forty-first degree of north latitude, one hundred and twenty miles west of the western boundary line of the Commonwealth of Pennsylvania, as now claimed by said Commonwealth, and from thence by a line drawn north, parallel to and one hundred and twenty miles west of the said west line of Pennsylvania, and to continue north until it comes to forty-two degrees and two minutes north latitude. Whereby all the right, title, interest, jurisdiction, and claim of the State of Connecticut to the lands lying west of said line to be drawn as aforementioned, one hundred and twenty miles west of the western boundary line of the Commonwealth of Pennsylvania, as now claimed by said Commonwealth, shall be included, released, and ceded to the United States in Congress assembled, for the common use and benefit of the said States, Connecticut inclusive.

The cession of South Carolina was described as follows:

* * * All the territory or tract of country included within the river Mississippi and a line beginning at that part of the said river which is intersected by the southern boundary line of the State of North Carolina, and continuing along the said boundary line until it intersects the ridge or chain of mountains which divides the eastern from the western waters, then to be continued along the top of said ridge of mountains until it intersects a line to be drawn due west from the head of the southern branch of Tugaloo River to the said mountains; from thence to run a due west course to the river Mississippi.

The State of North Carolina ceded—

The lands situated within the chartered limits of the State, west of a line beginning on the extreme height of Stone Mountain, at the place where the Virginia line intersects it; running thence along the extreme height of the said mountain to the place where the Watauga River breaks through it; thence a direct course to the top of the Yellow Mountain where Bright's road crosses the same; thence along the ridge of the said mountain, between the waters of Doe River and the waters of Rock Creek, to the place where the road crosses the Iron Mountain; from thence along the extreme height of the said mountain to where Nolechucky River runs through the same; thence to the top of the Bald Mountain; thence along the extreme height of the said mountain to the Painted Rock, on French Broad River; thence along the highest ridge of the said mountain to the place where it is called the Great Iron or Smoky Mountain; thence along the extreme height of the said mountain to the place where it is called the Unicoy or Unaka Mountain, between the Indian towns of Cowee and Old Chota; thence along the main ridge of the said mountain to the southern boundary of this State.

It will be noted that the above description of the eastern boundary of her ceded possessions agrees in general terms with the description of the western boundary of North Carolina, as given on page 102.

The articles of cession by Georgia describe the area ceded as follows:

The lands situated within the boundaries of the United States, south of the State of Tennessee and west of a line beginning on the west bank of the Chattahouchee River, where the same crosses the boundary line between the United States and Spain; thence running up the said river Chattahouchee and along the western bank thereof to the great bend thereof, next above the place where a certain creek or river, called Uchee (being the first considerable stream on the western side, above the Cussetas and Coweta towns), empties into the said Chattahouchee River; thence in a direct line to Nickajack, on the Tennessee River; thence crossing the last-mentioned river, and thence running up the said Tennessee River and along the western bank thereof to the southern boundary line of the State of Tennessee.

Of the area thus ceded to the General Government, the part lying north of the Ohio was afterwards erected into the "Territory Northwest of the River Ohio," and the balance, lying south of that river, was known as the "Territory South of the River Ohio."

TERRITORY NORTHWEST OF THE RIVER OHIO.

This territory was bounded on the west by the Mississippi and the international boundary, on the north by the boundary line between the United States and the British Possessions, on the east by the Pennsylvania and New York state lines, and on the south by Ohio River. It comprised an area of, approximately, 266,000 square miles. It was made up of claims of different States as follows:

1. Virginia uncontested claims, which consisted of all the territory west of Pennsylvania and north of the Ohio to the forty-first parallel of north latitude, besides her claim, by capture, as far as the northern limits of the land under the crown which had been subject to the jurisdiction of the provinces of Quebec and to Lakes Michigan and Huron.

2. The claim of Connecticut, which extended from the forty-first parallel northward to the parallel of 42° 2′, and from the west line of Pennsylvania to the Mississippi River.

3. The claim of Massachusetts, which extended from the north line of the Connecticut claim above noted to 43° 43′ 12″ north latitude, and from the eastern boundary of New York to the Mississippi.

4. The belt or zone lying north of the Massachusetts claim, extending thence to the Canada line and west to the Mississippi River, was claimed to have been obtained by the treaty of peace of Great Britain, September 3, 1783.

5. At the cession by the state of Virginia, both Massachusetts and New York claimed the Erie purchase of about 316 square miles, which was subsequently bought by Pennsylvania and added to that State.

From this territory were formed the following States: Ohio, Indiana, Illinois, Michigan, Wisconsin, that part of Minnesota east of the Mississippi River, and the northwest corner of Pennsylvania.

In 1787 a bill for its provisional division into not less than three nor more than five States was passed by Congress. In this bill the limits of the proposed States were defined, corresponding in their north and south lines to the boundaries of Ohio, Illinois, and Indiana, as at present constituted. The following gives the text of the clause defining these boundaries:

CONFEDERATE CONGRESS—AN ORDINANCE FOR THE GOVERNMENT OF THE TERRITORY OF THE UNITED STATES NORTHWEST OF THE RIVER OHIO.

* * * * * * *

ARTICLE 5. There shall be formed in the said territory not less than three nor more than five States; and the boundaries of the States, as soon as Virginia shall alter her act of cession and consent to the same, shall become fixed and established as follows, to wit: The western State, in said territory, shall be bounded by the Mississippi, the Ohio, and the Wabash River; a direct line drawn from the Wabash and Post Vincents, due north, to the territorial line between the United States and Canada; and by the said territorial line to the Lake of the Woods and Mississippi. The middle State shall be bounded by the said direct line, the Wabash from Post Vincents to the Ohio, by the Ohio, by a direct line drawn due north from the mouth of the Great Miami to the said territorial line, and by the said territorial line. The eastern State shall be bounded by the last-mentioned direct line, the Ohio, Pennsylvania, and the said territorial line: *Provided, however,* And it is further understood and declared, that the boundaries of these three States shall be subject so far to be altered, that, if Congress shall hereafter find it expedient, they shall have authority to form one or two States in that part of the said territory which lies north of an east and west line drawn through the southerly bend or extreme of Lake Michigan.

Passed July 13, 1787.

The provisions of this bill seem, however, never to have been carried out. A provisional government was instituted in 1788. By act of May 7, 1800, Congress divided this territory into two territorial governments, the divisional line being a meridian passing through the mouth of the Kentucky River and extending thence northward to the Canada border. The eastern portion became the "Territory Northwest of the River Ohio," and the western portion, Indiana Territory.

On November 29, 1802, the State of Ohio, comprising most of the former, was formed and admitted into the Union, while the remnant of it was added to Indiana Territory.

In 1805, all that portion of Indiana Territory lying north of a parallel through the most southerly bend of Lake Michigan and east of a meridian drawn through the same point became the Territory of Michigan. The boundary between these territories was subsequently very much changed, as will appear in the sequel.

By act of February 3, 1809, Indiana Territory was again divided, and the Territory of Illinois was created from the part lying west of the Wabash River and a meridian running through the city of Vincennes, extending thence to the Canada line.

In 1816 Indiana, and in 1818 Illinois, were admitted to the Union as States, each with its boundaries as constituted at present. By the same act the Mississippi River was made the western boundary of the Territory of Michigan, thus making it include all the balance of the original Northwest Territory after the formation of the three States of Ohio, Indiana, and Illinois.

The act of 1834 added to Michigan Territory the land between the Missouri and White Earth Rivers on the west and the Mississippi River on the east.

Wisconsin Territory was formed in 1836 from the portion of Michigan Territory west of the present State of Michigan. On January 26, 1837, Michigan was admitted into the Union, with its present boundaries. In 1838 all that portion of Wisconsin Territory lying west of the Mississippi River and a line drawn due north from its source to the international boundary (that is, all that part which was originally comprised in the Louisiana purchase) was made the Territory of Iowa, and in 1848 Wisconsin was admitted as a State, with its boundaries as at present constituted.

This appears to leave the area which is now the northeastern part of Minnesota, lying east of the Mississippi River and a line drawn due north from its source, without any government until the formation of Minnesota Territory, in 1849.

TERRITORY SOUTH OF THE RIVER OHIO.

The "Territory South of the River Ohio" was bounded on the north by the present northern boundary of Tennessee, on the south by the thirty-first parallel of latitude, on the east by the States of Virginia, North Carolina, South Carolina, and Georgia, and on the west by Mississippi River. The different cessions from the States which made up this region are as follows:

1. The area ceded by North Carolina, which extended from 36° 30′ north latitude southward to 35°, and from the western boundary line of

the present State to the Mississippi River. This is now the State of Tennessee.

2. The area ceded by South Carolina, which formed a narrow belt, 12 or 14 miles in width, lying south of the thirty-fifth parallel, and extending from her western boundary to the Mississippi River. It is doubtful whether under the terms of the original charters South Carolina possessed this strip, or whether it was not included in the possessions of Georgia.

3. The area ceded by Georgia, which comprised most of the region of the present States of Alabama and Mississippi, north of the thirty-first parallel.

Tennessee was admitted as a State in 1796. In 1798 Congress organized the Territory of Mississippi, which was originally a small, rectangular area, bounded on the west by the Mississippi River, on the north by a parallel through the mouth of the Yazoo River; the boundary on the east was the river Chattahoochee, and on the south the thirty-first parallel of north latitude. This area was subsequently enlarged so as to include the whole of what is now Mississippi and Alabama, with the exception of a strip along the Gulf coast, which was at that time claimed by Spain. In 1817 the Territory was divided, and the eastern portion was made into Alabama Territory. Subsequently the two Territories were admitted as States.

LOUISIANA AND THE TERRITORY ACQUIRED FROM MEXICO.

The Louisiana purchase was effected in 1803. In 1804 it was divided into two parts, that portion which now comprises the State of Louisiana being organized as Orleans Territory, while the balance remained as the Louisiana Territory. The State of Louisiana, comprising most of the Territory of Orleans, was admitted to the Union in 1812, and in the same year it was enlarged by the addition of the portion lying between the Mississippi and Pearl rivers, in the southeastern part. In the same year the name of Louisiana Territory was changed to Missouri Territory. In 1819 Arkansaw Territory was created, and in 1836 it was admitted as a State.

In 1820 the State of Missouri was formed from another portion of Missouri Territory, and in 1836 the boundaries of this State were enlarged to their present limits. In 1834, as was stated above, that portion of this Territory lying north of the State of Missouri and east of the Missouri and White Earth rivers was attached to the Territory of Michigan. In 1836 this portion was transferred from the Territory of Michigan to the Territory of Wisconsin. In 1838 it was transferred to the Territory of Iowa. In 1845 the State of Iowa was created, and in 1846 its boundaries were enlarged. In 1849 the remainder of the Territory was transferred to Minnesota Territory. Minnesota was admitted as a State on May 11, 1858, with its present boundaries.

Meantime Texas had been admitted to the Union, and by the treaty of Guadalupe-Hidalgo and the Gadsden purchase, we had acquired from Mexico all the area west of the northern part of Texas and south of the forty-second parallel. Furthermore, our northern boundary had been established on the forty-ninth parallel to the Pacific Ocean.

Out of this great western region were carved the following Territories:

Oregon Territory, which was formed in 1848, and which extended from the parallel of 49° north latitude southward to latitude 42°, and from the Pacific Ocean east to the summit of the Rocky Mountains.

California, which was admitted as a State in 1849, with the same limits which it possesses at present.

Utah Territory, which was formed in 1850, and which extended from the forty-second parallel southward to the thirty-seventh, and from the California boundary line eastward to the Rocky Mountains.

New Mexico, which comprised all the country lying south of Utah to the boundary line of Texas and Mexico, and from the California boundary eastward to the boundary of Texas.

Nebraska Territory, which was formed from Missouri Territory in 1854. It comprised the country from the forty-ninth parallel down to the fortieth and from the Missouri and White Earth Rivers west to the summit of the Rocky Mountains.

Kansas Territory, formed by the same act as the last, comprised the country lying west of Missouri to the boundary of New Mexico and Utah, and from the south boundary of Nebraska to the thirty-seventh parallel.

Indian Territory then had its present limits.

Washington Territory was formed in 1853 from a part of Oregon, its southern boundary being Columbia River and the parallel of 46° north latitude, and its east line being the summit of the Rocky Mountains.

Oregon was admitted as a State in 1857, with its boundaries as at present established. The portion cut off from Oregon Territory was placed under the territorial government of Washington.

Dakota Territory was formed in 1861. As originally formed it comprised all that region between its present eastern and southern boundaries, while its western boundary was the summit of the Rocky Mountains.

The Territory of Nevada was organized from the western portion of the Territory of Utah in 1861. As originally constituted, its eastern line was the meridian of thirty-nine degrees of longitude west from Washington, and its southern boundary was the parallel of thirty-seven degrees of latitude. It was admitted as a State in 1864, its eastern boundary being made the thirty-eighth degree of longitude (approximately the one hundred and fifteenth degree west from Greenwich), while its southern boundary remained the same. In 1866, by act of Congress, the eastern boundary was moved one degree farther to the eastward, placing it upon the thirty-seventh degree of longitude west from Washington, and the triangular portion contained between the former southern boundary, the boundary of California, the Colorado River and the meridian of thirty-seven degrees of longitude was added, thus giving the State its present area and limits.

Colorado Territory was formed in 1861, with the limits of the present State. It was admitted as a State in 1876.

The Territory of Arizona was formed from New Mexico in 1863, being that portion of New Mexico lying west of the thirty-second meridian west of Washington.

In the same year Idaho was formed from parts of Dakota and Washington Territories. As originally constituted it included all the territory lying east of the present eastern limits of Oregon and Washington Territory to the twenty-seventh degree of longitude west of Washington, the latter meridian being its eastern boundary. Its southern boundary was the northern boundary of Colorado and Utah—that is, the forty-first and forty-second parallels of latitude.

From this Territory was detached, in 1864, the Territory of Montana, with its present limits, and in 1868 the Territory of Wyoming, these several changes reducing Idaho to its present dimensions.

CHAPTER III.

THE BOUNDARY LINES OF THE STATES AND TERRITORIES.

MAINE.

The first charter having any relation to the territory comprising the present State of Maine is that granted by Henry IV of France to Pierre du Gast, Sieur de Monts, in 1603, known as the charter of Acadia, which embraced the whole of North America between the fortieth and forty-sixth degrees of north latitude. Under this, several expeditions were made, and in 1606 it was decided to make a permanent settlement at Port Royal, now Annapolis, Nova Scotia, and no further attempts were made under this charter to plant colonies within the limits of the present State of Maine. (*Vide* Charters and Constitutions, p. 771.)

By the first charter of Virginia (*vide* Virginia, p. 94), granted by James I, in 1606, the lands along the coast of North America between the thirty-fourth and forty-fifth degrees of north latitude were given to two companies, to one of which, the Plymouth Company, was assigned that part of North America including the coast of New England. The first colony in Maine was planted on the peninsula of Sabine, at the mouth of Kennebec River, now Hunnewell Point, on August 19, 1607, O. S., by George Popham.

James I in 1620 granted a charter to the Plymouth Company, in which may be found the following, viz:

> Wee, therefore * * * do grant ordain and establish that all that Circuit, Continent, Precincts and Limitts in America lying and being in Breadth from Fourty Degrees of Northerly Latitude from the Equnoctial Line, to Fourty eight Degrees of the said Northerly Latitude and in length by all the Breadth aforesaid throughout the Maine Land from Sea to Sea—with all the Seas, Rivers, Islands, Creekes, Inletts, Ports and Havens within the Degrees, Precincts and Limitts of the said Latitude and Longitude shall be the Limitts, and Bounds, and Precincts of the second collony—and to the end that the said Territoryes may hereafter be more particularly and certainly known and distinguished, our Will and Pleasure is, that the same shall from henceforth be nominated, termed and called by the name of New England in America.

Under this grant, given in 1621, the Earl of Stirling claimed that he was entitled to land on the coast of Maine which was afterwards granted to the Plymouth Company, and by direction of James I that company issued a patent to William Alexander, Earl of Stirling,

> For a tract of the main land of New England, beginning at Saint Croix and from thence extending along the sea-coast to Pemquid and the river Kennebeck. (*Vide* Charters and Constitutions, p. 774.)

The heirs of the Earl of Stirling sold this tract to the Duke of York in 1663. (*Vide* Zell's Encyclopædia.)

In 1622 Capt. John Mason and Sir Ferdinando Gorges obtained from the council of Plymouth a grant of the lands lying between the Merrimac and Kennebec Rivers, and extending back to the river and lakes of Canada. This tract was called Laconia, and it included New Hampshire and all the western part of Maine. (*Vide* Whiton's New Hampshire.)

Mason and Gorges, in 1629, by mutual consent divided their territory into two by the river Piscataqua. That part on the east of this river was relinquished to Gorges, who called it Maine. (*Vide* Whiton's New Hampshire.)

The charter of the Plymouth Company was surrendered to the King in the year 1635. (*Vide* Plymouth Colony Laws, p. 333 *et supra.*)

King Charles I, in the year 1639, granted a charter to Sir Ferdinando Gorges, which virtually confirmed the patent given to him by the Plymouth Company in 1622.

The following extract from that charter defines the boundaries:

> All that Parte Purparte and Porcon of the Mayne Lande of New England aforesaid beginning att the entrance of Piscataway Harbor and soe to passe upp the same into the River of Newichewanocke and through the same unto the furthest heade thereof and from thence Northwestwards till one hundred and twenty miles bee finished and from

Piscataway Harbor mouth aforesaid Northeastwards along the Sea Coasts to Sagadahocke and up the River thereof to Kynybequy River and through the same into the heade thereof and into the Lande Northwestwards untill one hundred and twenty myles bee ended being accompted from the mouth of Sagadahocke and from the period of one hundred and twenty myles aforesaid to crosse over Lande to the one hundred and twenty myles end formerly reckoned upp into the Lande from Piscataway Harbor through Newichewanocke River and also the Northe halfe of the Isles of Shoales togeather with the Isles of Capawock and Nawtican neere Cape Cod as alsoe all the Islands and Iletts lyeinge within five leagues of the Mayne all alonge the aforesaide coasts betweene the aforesaid River of Pascataway and Sagadahocke with all the Creeks Havens and Harbors thereunto belonginge and the Revercon and Revercons Remaynder and Remaynders of all and singular the said Landes Rivers and Premisses. All which said Part Purpart or Porcon of the Mayne Lande and all and every the Premisses herein before named Wee Doe for us our heires and successors create and incorporate into One Province or Countie, and Wee Doe name ordeyne and appoynt that the porcon of the Mayne Lande and Premises aforesaid shall forever herefter bee called and named The Province or Countie of Mayne.

In 1664 Charles II granted to the Duke of York, who, the year before, had purchased the territory, which had been awarded to the Earl of Stirling in the division of the country to his heirs, a portion of the present State of Maine, and also certain islands on the coast, and a large territory west of the Connecticut River. (For the boundaries *vide* New York, p. 76 *et seq.*)

In 1674 Charles II made a new grant to the Duke of York, in substantially the same terms as that of 1664, including as before a portion of Maine. (*Vide* New York, p. 77.)

In the year 1677, Ferdinando Gorges, a grandson of Sir Ferdinando Gorges sold and gave a deed of the province of Maine to John Ushur, a merchant, of Boston, for £1,250. In the same year, Ushur gave a deed of the same territory to the governor and company of Massachusetts Bay, who had received a grant from the council of Plymouth in 1628, confirmed by the King in 1629. (*Vide* C. & C., p. 774.)

In 1686 Pemaquid and its dependencies, forming Cornwall County, under the jurisdiction of New York, were annexed to the New England government by a royal order, dated September 19, 1686. (*Vide* Maine Historical Society Collection, vol. 5.)

The charter of Massachusetts Bay of 1629 having been canceled in 1684, in 1691 William and Mary granted a new one, incorporating the provinces of Maine and Acadia, or Nova Scotia, with the colonies of Massachusetts Bay and of Plymouth, into one royal province by the name of the Royal Province of Massachusetts Bay. (*Vide* Mass., p. 54.)

The right of government thus acquired over the district of Maine was exercised by Massachusetts until 1819 when measures were taken to admit Maine as an independent State.

By the treaty of Paris in 1763 the King of France relinquished all claim to that portion of North America which includes the present State of Maine.

The northern and eastern boundaries were settled by the United States and Great Britain. (See p.13, *et seq*).

The western boundary was for a long time a source of contention between Maine and New Hampshire.

New Hampshire having been made a province in 1679, controversies arose concerning the divisional line.

In 1731 commissioners from New Hampshire and from Massachusetts having been appointed, met, but were unable to agree. New Hampshire appealed to the King, and the King ordered that a settlement should be made by commissioners from the neighboring provinces. The board met at Hampton in 1737. The commissioners fixed on—substantially—the present boundary, wording their report as follows:

> Beginning at the entrance of Pascataqua Harbor, and so to pass up the same to the River Newhichawack, and thro' the same into the furthest head thereof, and thence run north 2 degrees west till 120 miles were finished, from the mouth of Pascataqua Harbor, or until it meet with His Majesty's other Governments. (See N. H. Historical Coll., Vol. II.)

This was confirmed by the King, August 5, 1740.

In 1820 Maine was admitted, as an independent State.

Difficulties having arisen about the boundary between Maine and New Hampshire, commissioners were appointed in 1827 from each State to determine the same.

In 1829 the commissioners' report was adopted by each State, and the line then settled upon is as follows, using the language of the commissioners' report, viz:

> The report of the commissioners appointed by His Majesty's order in Council of February 22nd, 1735, and confirmed by his order of the 5th of August, 1740, having established—
>
> "That the dividing line shall pass up through the mouth of Piscataqua Harbor, and up the middle of the river of Newichwannock, part of which is now called the Salmons Falls, and through the middle of the same to the farthest head thereof, &c.," and "that the dividing line shall part the Isle of *Sholes*, and run through the middle of the harbor, between the islands to the sea on the southerly side, &c." We have not deemed it necessary to commence our survey until we arrived north, at the head of Salmon Falls River, which was determined by Bryant, at his survey in 1740, to be at the outlet of East pond, between the towns of Wakefield and Shapleigh. From that point we have surveyed and marked the line as follows, viz:
>
> We commenced at the Bryant Rock, known as such by tradition, which is a rock in the middle of Salmon Falls River, at the outlet of East pond, about six feet in length, three feet in breadth, three feet in depth, and two feet under the surface of the water, as the dam was at the time of the survey, to wit, October 1, 1827; said stone bears south, seventy-one degrees west, three rods and eight links from a large rock on the eastern bank, marked "1827," and bears also from a rock near the mill-dam (marked "H") north, nineteen degrees and thirty minutes west, and distant twelve rods and twenty-one links. At this point the variation of the needle was ascertained to be *nine degrees* west.
>
> From the above stone the line is north seven degrees and forty-one minutes east, one hundred and seventy-eight rods to East pond, and crossing the pond three hundred and eleven rods in width to a stone monument which we erected up on the bank, about three and an half feet high above the surface of the ground, marked N on the

west side and M on the east side, which description applies to all the stone monuments hereinafter mentioned unless they are otherwise particularly described; thence the same course, two hundred and twenty-five rods, to Fox Ridge, and to a stone monument which is placed upon the north side of the road that leads from Wakefield to Shapleigh; thence two hundred rods to Balch's pond; across the pond, one hundred and three and half rods; across a peninsula, thirty-six rods; across a cove, fifty-one rods and seventeen links; across a second peninsula, forty-eight rods; across a second cove, twenty-seven rods, ten links.

Thence three hundred and seventy rods, to the road leading from Newfield to Wakefield and a stone monument, erected on the north side of the same, near Campernell's house; thence north six degrees and ten minutes east, five hundred and ninety rods, to the line of Parsonfield, to a stone monument with additional mark "1828."

At this point the variation of the needle was found to be nine degrees fifteen minutes west. Thence same course five hundred and eleven rods, crossing the end of Province pond to a stone monument on the Parsonfield road, near the house of James Andrews, also with additional mark "1828"; thence north eight degrees and thirty-eight minutes east, two hundred and eight rods, to the old corner-stone of Effingham, about two feet above the ground, and not marked; thence north eight degrees fifty-five minutes east, two hundred and seventy-seven rods, to a large round stone about three feet diameter and two feet high, marked N and M, by the road upon Towles hill; thence north seven degrees fifty-five minutes east, six hundred and thirty-one rods to a stone monument, on the road leading from Parsonfield to Effingham. At this point the variation of the needle was found to be 9 degrees thirty minutes west. Thence north five degrees two minutes east, seven hundred thirty-four to a pine stump, upon a small island in Ossipee River at the foot of the falls; thence north ten degrees east, thirty rods, to a stone monument, on the north side of the new road from Porter to Effingham; thence the same course, five hundred fifty-eight rods, to the top of Bald Mountain; thence same course, three hundred sixteen rods, to the top of Bickford Mountain; thence same course one hundred and ninety-three rods, to a stone monument, on the north side of the road, leading from Porter to Eaton.

At this point the variation of the needle was found to be nine degrees forty-five minutes west; thence north eight degrees five minutes east, seven hundred and forty-four rods, to Cragged Mountain; thence same course, sixty-seven rods, to the corner of Eaton; thence same course, seven hundred eighty-seven and an half rods, to the corner of Conway; thence same course, six hundred ten and an half rods, to a stone monument, on the south side of the road, leading from Brownfield to Conway Center; thence north eight degrees east, eight hundred seventy-one rods, to a stone monument on the south side of the road leading from Fryeburg Village to Conway. At this point the variation of the needle was found to be ten degrees west; thence same course, four rods, to a stone monument on the north side of the same road; thence north eight degrees fifteen minutes east, one hundred two rods, to Saco River; thence same course, eighteen rods, across said river; thence same course, six hundred forty-four rods, to a stone monument on the road leading to Fryeburg Village, on the north side of the river.

This monument is marked as before described, and is about eight feet high above the ground; thence same course, one hundred forty-two rods, to Ballard's Mill Pond; thence same course, sixty-one rods, six links, across said pond; thence same course, three hundred forty-four rods, to a stone monument on the east side of Chatham road; thence same course, six hundred ninety rods, to Kimball's Pond; thence same course, one hundred sixty-six rods, across said pond; thence same course, sixty rods, to a stone monument on the meadow.[1] Thence same course, nine hundred forty rods, to the corner of Bradley and Eastman's grant; thence same course, six hundred and ninety rods, to a stone monument on the east side of the Cold River road. This stone is marked as before described, but is not more than two feet above the ground. Thence same course, one thousand five hundred forty rods, to the corner of Warner and Gilman's location, a pile of stones. At this point the variation of the needle was found to be ten degrees twenty-three minutes west; thence same course, four hundred and fifty rods, to top of Mount Royce; thence same course, eight hundred ninety-eight rods, to Wild River; thence same course, eight rods, across said river; thence same course, seven hundred sixty-five rods, to a stone monument on the north side of the road leading from Lancaster to Bethel; thence same course, one hundred rods, to Androscoggin River; thence same course, eighteen rods, across said river; thence north eight degrees ten minutes east, four thousand one hundred sixty-two rods, across ten streams, to Chickwalnepg River; thence same course, two thousand five hundred rods, to a stone monument on the north side of the road leading from Errol to Andover. This stone is marked "N. H." and "M.," thence same course two hundred ten rods to Cambridge River, thence same course eight rods across said river, thence same course five hundred sixty-seven rods to Umbagog Lake, thence same course thirty-four rods across a cove of the same, thence same course ten rods across a peninsula of the same, thence same course two hundred twenty-five rods across a bay of said lake, thence same course two hundred six rods across a peninsula of the same, thence same course one thousand one hundred sixty-five rods across the north bay of said lake to a cedar post marked "N." "M.," thence north eight degrees east seven hundred fourteen rods to Pond brook; thence same course two hundred twenty-five rods to a stone monument on the south side of the Margallaway River, thence same course ten rods across said river, thence same course one hundred sixty-two rods to a spruce, corner of the college grant, thence same course two hundred sixty-four rods to Margallaway River a second time. At this point the variation of the needle was found to be eleven degrees forty-five minutes west; thence same course ten rods across said river, thence same course two hundred and ninety rods to same river a third time, thence same course ten rods across said river to a monument made with three stones on the north side of said river, about two feet high and not marked, thence same course four hundred forty-four rods to corner of township number five, in second range, in Maine, thence same course one thousand eight hundred six rods to the north corner of the same township, thence same course four hundred and sixty rods to a branch of Little Diamond River, thence same course three hundred fifty rods to another branch of the same, thence same course two thousand one hundred twenty rods to a branch of the Margallaway River, thence same course three hundred thirty-two rods to another branch of the same, thence same course four hundred rods to a steep mountain called Prospect Hill, thence same course nine hundred and twenty rods to Mount Carmel, sometimes called Sunday Mountain, thence same course four hundred rods to a perpendicular precipice, thence same course five hundred and forty rods to a branch of Margalloway River, thence same course two hundred and sixty rods to a branch of the same, thence same course three hundred forty-six rods to a second steep precipice, thence same course one hundred eighty-six rods to a branch of Margallaway River, thence same course two hundred forty-two rods to another branch of same river, thence same course seventy-eight rods to a beaver pond, thence same course one hundred twenty-six rods to a yellow birch tree on the highlands which divide the waters that run south from those that run into the St. Lawrence, being the northern extremity of the line and one hundred and twelve miles two hundred and thirty-three rods from the head of Salmon Falls River.

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[1] From this point the line was resurveyed in 1858, *vide* p. 44.

Found said tree marked on the east side "M. E. 1789," and on the west "N. H. N. E.;" also "M. 54." To these marks we added "N. H.," "N. E.," and "M. E.," "1828," "E. H.," "A. M. M.," "1828," and stones were piled round the same and marked.

The whole course of the line from the Androscoggin River was re-marked by spotting the old marked trees and crossing the spots and marking others in the course. And the line as above survey and described we agree to be the true boundary line of said States. And the above-described marks and monuments we establish to designate the same, and that the said line hereafter remain the boundary line between the States, unless the legislature of either State shall, at the first session after the execution of this agreement, disapprove of the same.

WILLIAM KING,
RUFUS McINTIRE,
Commissioners of Maine.
ICHABOD BARTLETT,
JOHN W. WEEKS,
Commissioners of New Hampshire.

NOVEMBER 13, 1828.

The legislature of Maine approved of the commissioners' report February 28, 1829, and requested the governor to issue his proclamation accordingly.

The same action was taken by the legislature of New Hampshire, July 1, 1829.

(For Report of Commissioners, see Laws of Maine, 1828–'9, under head of Resolves of the Ninth Legislature of the State of Maine, pages 39–43.)

Between 1828 and 1858, considerable portions of the amost unbroken forests through which the line of 1827–'28 was marked were cleared. Extensive forest fires often swept large tracts of this territory, and, as a consequence, the marks of the 1827–'28 survey for a distance of nearly eighty miles—which by that survey was mainly fixed by blazed trees, —only *seven* stone posts having been set in this distance—were obliterated, so that there remained scarcely a vestige of the original line. The lands having become valuable, and litigation in many cases being imminent, the legislatures of the two States in 1858 provided by enactment for another survey from Fryeburg to the Canada line—which was made the same year. The line as then surveyed is as follows, viz:

Commencing at an iron post[1] situated on the line run in accordance with the "Treaty of Washington, of August 9, 1842," as the boundary between the United States and the province of Canada, at the corners of the States of Maine and New Hampshire. On the south face of said post are the words "Albert Smith, U. S. Comsar."; on the north face, "Lt. Col. I. B. B. Eastcourt, H. B. M. Comsar."; on the west face, "Boundary, Aug. 9, 1842"; on the east face, "Treaty of Washington." To the marks are added on the southern half of the west face, "H. O. Kent." A large flat stone was placed on the southern face of the monument and marked "1858—N. H., Me.," on either side of a line cut in said stone bearing the direction of the State's line, viz, south, 8 degrees west.

From this point the line is south 8 degrees west, 17 rods, 7 links to a large yellow birch stub, the northern terminus of the former survey; thence 126 rods to a beaver pond; thence 73 rods to the northwesterly branch of the Margallaway, known as Kent River; thence 242 rods to another branch of the Margallaway; thence 186 rods to a certain steep precipice perpendicular on its southern face; thence 346 rods to a branch of the Margallaway River; thence 260 rods to another branch of the same; thence 540 rods to a precipice, the southern side of Mount Abbott; thence 400 rods to the summit of Mount Carmel; thence 920 rods, and across four streams, to the summit of Prospect Hill.

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[1] The position of this post is given in Hitchcock's Geological Survey of New Hampshire, as follows, viz, latitude, 45° 18′ 23″.33; longitude, 71° 5′ 40″.5.

On this distance we marked a yellow birch tree "H. O. Kent, September 20, 1858," and the names of the remainder of the party; thence 400 rods to another branch of the Margallaway; thence 332 rods to the Little Margallaway River; thence 2,120 rods across Bosebuck Mountain to a branch of said river. On this distance at the northwest corner of township No. 5, range 3, in Maine, we marked a white birch tree, "N. H. M.," and on its north and south sides, "IV, III." Thirty rods from the summit of Bosebuck Mountain, and on its northern slope, we erected a stone monument marked "N. M."; thence 350 rods to the Little Diamond River or Abbott Brook; thence 460 rods to the northwest corner of township No. 5, range 2, in Maine. On this distance we found an ancient yellow birch tree marked "1789–35, M." To these marks we added "1858"; thence 1,806 rods to the southwest corner of the same township. On this distance, at the northeast corner of Dartmouth College, second grant in N. H., we marked a large yellow birch tree "Me., J. M. W., 1858; N. H., H. O. K."; thence, and across an open bog, 444 rods to the north bank of the Margallaway River, to a white maple tree marked "N. H. M."; thence 10 rods across said river to a large pine tree marked "M." "N. H."; thence and across a second open bog 290 rods to the same river and to a large elm stub; thence 10 rods across said river; thence 264 rods to a spruce post marked "M." "N. H.", "W. L.", "D. C.", being the southeast corner of Dartmouth College, second grant; thence 162 rods to the Margallaway River; thence 10 rods across said river to a stone monument on its southerly side, standing about 3 feet above the ground and marked "M." "N. H."; thence to the original line tree nearest to the clearing of the home farm of Z. F. Durkee, esq. *The course of the line the entire distance from the iron post at the national boundary to this point bears south eight degrees west;* thence across said clearing, the old line marks being gone, south 11 degrees and 30 minutes west, 168 rods, to the old crossed trees in the woods south of Pond Brook; thence from Pond Brook south eight degrees west, 714 rods to the north bog of Umbagog Lake and to a cedar tree marked "M." "N." To this we added "1858."

On this distance near the corner of Errol and Wentworth's location, which is a cedar post in a pile of stones, we marked a maple tree "M. 1858," "N. H. 1858"; thence south ten degrees and thirty minutes west 1,165 rods, across the north bay of said lake to the old marked trees on the southern shore; thence south eight degrees west 206 rods across the peninsula to a cedar tree marked "M." "N. H." A large stone, also, on the lake shore was marked "M," "N. H."; thence same course 225 rods, across a bay of said lake; thence same course 10 rods, across a peninsula; thence same course 34 rods across a cove; thence same course 567 rods to Cambridge River; thence same course 8 rods, across said river to a white maple stub; thence same course 210 rods to a stone monument on the north side of the road leading from Andover, Me., to Colebrook, N, H.; thence same course to the north edge of the burnt land in Grafton and Success; thence south 11 degrees west across ten streams and the Chickwalmpy River, or Silver Stream, to the old line trees bearing the crosses, easterly of the south end of Success Pond; thence on the same course south 10 degrees west following the old mark to an ash tree bearing the original cross, standing a few rods north of the house of the late Daniel Ingalls, in Shelburne; thence south 11 degrees west to a stone monument, by the road on the north side of the Androscoggin River, and to the north bank of said river, the whole distance from the stone monument near Umbagog Lake to the north bank of the Androscoggin River, being 6,662 rods; thence south 11 degrees west 18 rods across said river; thence same course 100 rods, crossing the track of the Grand Trunk Railway to a stone monument on the north side of the road leading from Lancaster, N. H., to Bethel, Me.; thence same course, 765 rods to a hemlock tree on the south bank of Wild River; thence south 66 degrees 30 minutes west 34 rods on an offset of the old survey along said south bank to the old line trees; thence following the old line trees south 11 degrees west, passing the southeast corner of Shelburne, 898 rods to the top of Mount Royce, the whole distance being 1,881 rods. One mile north of the summit of Mount Royce we marked a beech tree "N. H." "M.," 1858; thence to a large stone marked "N. H." "Me."; thence south 10 degrees 15 minutes west to a stone monument on the east side of the Cold River road. On this distance at the foot of the first precipice on the northern face of Mount Royce a white-birch tree was marked "1858." Further on and east of a bare ledge a white-birch tree was marked "1858," and near it, on the line, a pile of stones was erected. At the first clearing, near the north end of a stone fence, a large stone was marked "M." "N. H."; thence along a stone fence and across a road through a piece of new growth and again crossing the road; then following another stone fence on the east side of the road, passing through a field and by the end of another stone fence; then crossing a road near the west end of a bridge over Cold River; then following the valley of that stream and crossing it six times; then crossing another road, where we placed a stone monument; then through a field, striking an old stump and pile of stones, shown as the old line and passing between a house and barn, and through the western edge of a grove of trees to the stone monument near the house of Mr. Eastman, the whole distance being 1,190 rods; thence 1,630 rods to a stone monument standing in the meadow 60 rods north of the north shore of Kimball's pond, in Fryeburg.

But as the towns of Fryeburg and Stowe have erected no durable monument on the State's line at their respective corners, we deemed it advisable, under our instructions, to proceed so far south as at least to pass the said corner and to complete the work at some well-defined monument of the old survey.

This course bore from the monument to and across an open bay south 12 degrees west; thence on the old trees south 9 degrees west 100 rods; thence on the old line south 10 degrees 30 minutes west to a stone monument erected by us near the house of Jonnet Clay, in Chatham, and on the north side of the road leading from Stowe to Chatham Corners; said monument is marked "M." "N. H." 1858; thence on the old line south 11 degrees west to the road leading from North Fryeburg to Chatham, at which point we placed a stone monument; thence south 11 degrees west to the northwest corner of Fryeburg, being a stake in a pile of stones in a piece of low ground, southerly of the house of Captain Bryant, and to the old monument, 60 rods north of Kimball's pond. On the bank north of said corner, on the south side of the road, and near Captain Bryant's house, we placed a stone monument marked "M." "N. H. 1858."

The different courses laid down in the foregoing report are the bearings of the compass in 1858 when placed on the line established in 1828. (See Legislative Journal of New Hampshire, 1859, pages 764–767.)

In 1874 the line between Maine and New Hampshire was resurveyed and marked. (*Vide* Hitchcock's Geology of New Hampshire, Vol. I, p. 173.)

NEW HAMPSHIRE.

The first charter of Virginia, granted in 1606, included the territory of the present State of New Hampshire (*vide* p. 38), as did the charter of New England, granted in 1620 (*vide* p. 39), and the grant to Capt. John Mason and Sir Ferdinando Gorges of 1622 (*vide* p. 39).

The president and council of New England made a grant to Capt. John Mason in 1629 as follows, viz:

* * * * * * *

> All that part of the main land in New England lying upon the sea coast, beginning from the middle part of Merrimack River, and from thence to proceed northwards along the sea-coast to Piscataqua River, and so forwards up within the said river and to the furthest head thereof, and from thence northwestwards until three score miles be finished from the first entrance of Piscataqua River and also from Merrimack through the said river and to the furthest head thereof, and so forward up into the lands westward until three score miles be finished, and from thence to cross overland to the three score miles, and accompted to Piscataqua River, together with all islands and islets within 5 leagues distance of the premises and abutting upon the same, or any part or parcel thereof, &c., * * * which said portions of lands * * * the said Capt. John Mason, with the consent of the president and council, intends to name *New Hampshire.* * * *

In 1635 the grant of 1629 was confirmed by a supplementary grant, of which the following is an extract, viz:

> All that part of the Mayn Land of New England aforesaid, beginning from the middle part of Naumkeck River, and from thence to proceed eastwards along the Sea Coast to Cape Anne, and round about the same to Pischataway Harbour, and soe forwards up within the river Newgewanacke, and to the furthest head of the said River and from thence northwestwards till sixty miles bee finished, from the first entrance of Pischataway Harbor, and alsoe from Naumkecke through the River thereof up into the land west sixty miles, from which period to cross over land to the sixty miles end, accompted from Pischataway, through Newgewanacke River to the land northwest aforesaid; and alsoe all that the South Halfe of the Ysles of Sholes, all which lands, with the Consent of the Counsell, shall from henceforth be called New-hampshyre. And alsoe ten thousand acres more of land on the southeast part of Sagadihoc at the mouth or entrance thereof—from henceforth to bee called by the name of Massonia, &c. * * *

After the death of Capt. John Mason (in December, 1635), the affairs of the colony coming into bad condition, they sought the protection of Massachusetts in 1641 and enjoyed it till 1675, when Robert Mason, a grandson of John Mason, obtained a royal decree, under which, in 1680, a colonial government was established. But no charter was given to the colony, and its government was only continued during the pleasure of the King. The following is an extract from the commission, or decree, issued by the King in 1680:

> Province of New Hampshire, lying and extending from three miles northward of Merrimack River or any part thereof into ye Province of Maine.

In the year 1690 the province of New Hampshire was again taken under the jurisdiction of Massachusetts Bay, but was again separated in 1692.

[For a history of the boundary between New Hampshire and Maine, *vide* Maine, p. 41.]

The controversy already referred to arising between the provinces of New Hampshire and Massachusetts Bay not only involved the settlement of the boundary between New Hampshire and Maine, but also that between New Hampshire and Massachusetts, and, as before stated (*vide* Maine, p. 41), the commissioners appointed by the two provinces having been unable to agree, New Hampshire appealed to the King, who ordered that the boundaries should be settled by a board of commissioners appointed from the neighboring colonies.

The board met at Hampton in 1737, and submitted a conditional decision to the King, who in 1740 declared in council as follows, viz:

> That the northern boundary of the province of Massachusetts be a similar curve line pursuing the course of the Merrimac River, at three miles distance, on the north side thereof, beginning at the Atlantic Ocean and ending at a point due north of Pautucket Falls, and a straight line drawn from thence, due west, till it meets with His Majesty's other Governments. (*Vide* Vermont State Papers, Slade, p. 9.)

New Hampshire claimed her southern boundary to be a line due west from a point on the sea three miles north of the mouth of Merrimac River. Massachusetts claimed all the territory three miles north of any part of Merrimac River. The King's decision gave to New Hampshire, a strip of territory more than fifty miles in length and of varying width, in excess of that which she claimed. This decree of the King was forwarded to Mr. Belcher, then governor of both the provinces of New Hampshire and Massachusetts Bay, with instructions to apply to the respective assemblies to unite in making the necessary provisions for running and marking the line conformable to the said decree, and if either assembly refused, the other was to proceed *ex parte*. Massachusetts Bay declined complying with this requisition. New Hampshire, therefore, proceeded alone to run and mark the line.

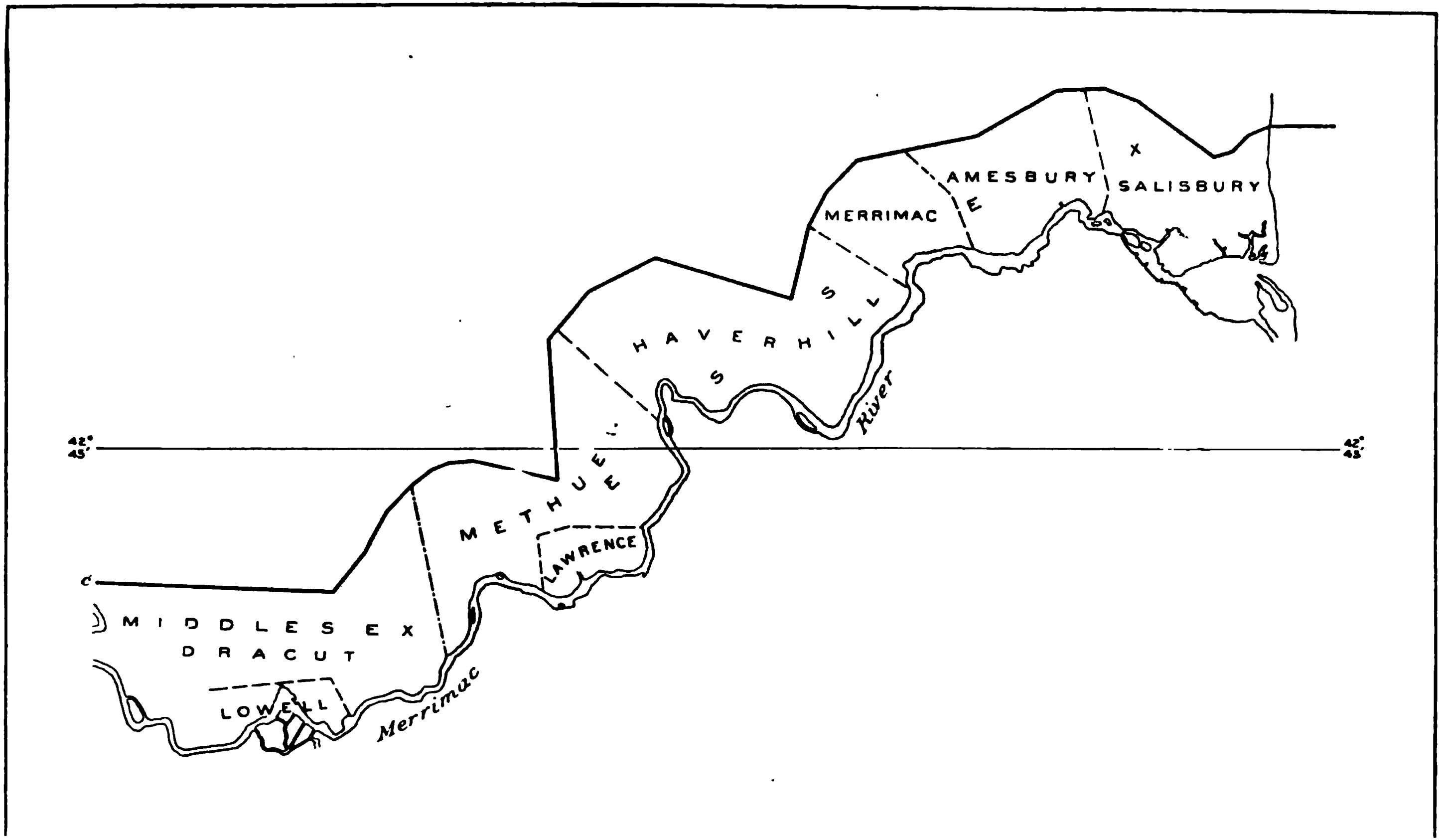
George Mitchel and Richard Hazen were appointed by Belcher to survey and mark the line. Pursuant to this authority, in the month of February, 1741, Mitchel ran and marked the line from the sea-coast about three miles north of the mouth of the Merrimac River to a point about three miles north of Pawtucket Falls, and Hazen, in the month of March following, ran and marked a line from the point, three miles north of Pawtucket Falls, across the Connecticut River, to the supposed boundary line of New York, on what he then supposed to be a due west course from the place of beginning. He was instructed by Governor Belcher to allow for a westerly variation of the needle of ten degrees. (*Vide* New Hampshire Journal H. R., 1826.)

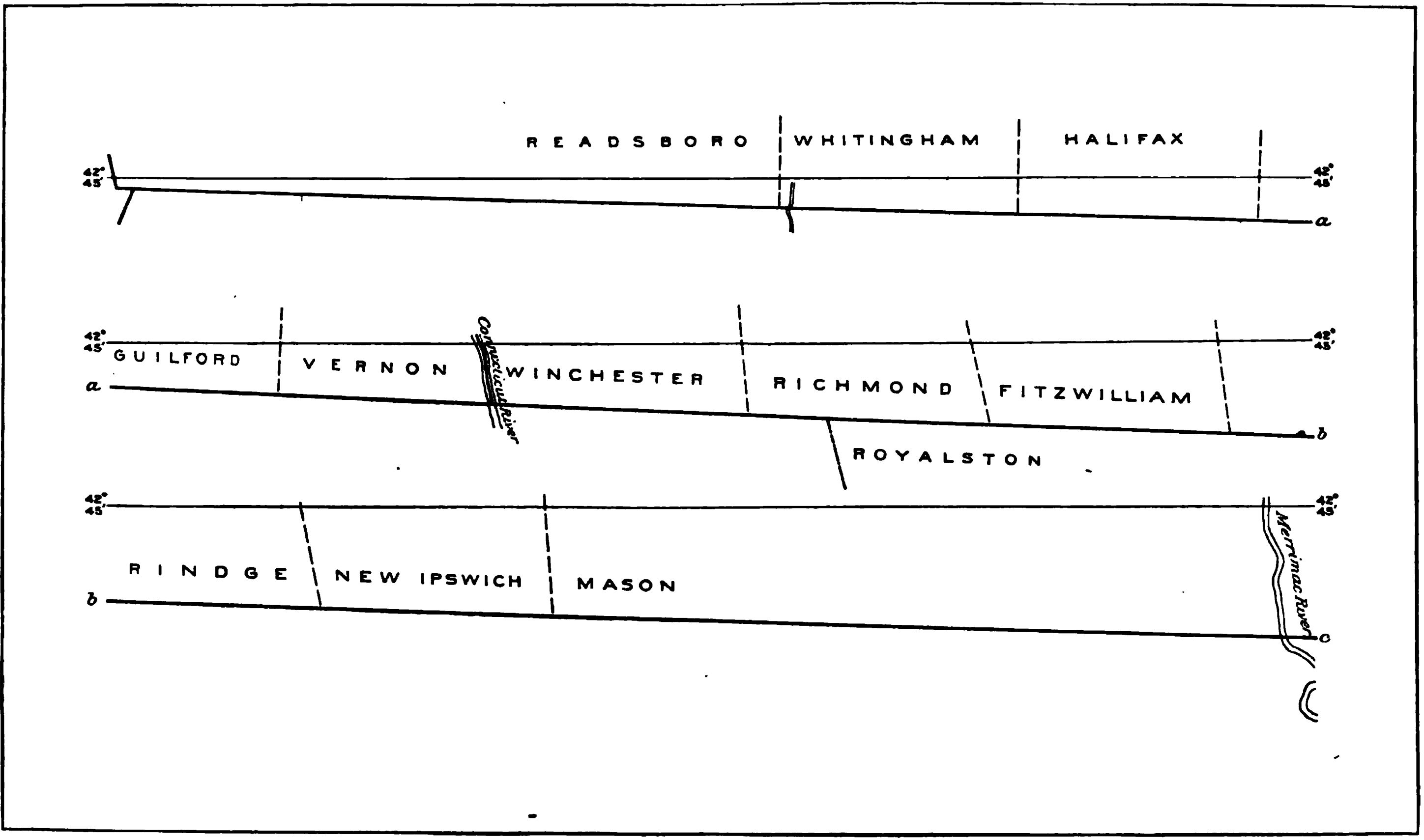
The report of the surveyors has not been preserved, but the journal of Hazen has been found, and is published in the New England Historical and Genealogical Register, July, 1879.

Subsequent investigation has proved that this line was not run on a due west course, the allowance for the westerly variation of the needle being quite too large, throwing the line north of west.

This mistake seems to have been known previous to the Revolution. In 1774 calculations were made by George Sproule, founded upon actual surveys and accurate astronomical observations, from which he determined that Hazen's line was so far north of west as to lose to the State of New Hampshire quite a large tract of land. (*Vide* New Hampshire Journal H. R., 1826.)

In 1825 commissioners were appointed by the States of New Hamp-


ESSEX
SALISBURY
AMESBURY
MERRIMAC
HAVERHILL
METHUEN
LAWRENCE
MIDDLESEX
DRACUT
LOWELL
Merrimac River
42° 45'
42° 45'



NORTH BOUNDARY OF MASSACHUSETTS.

shire and Massachusetts to ascertain, run, and mark the line between the two States, under the proceedings of which New Hampshire asserted her claim to a due west line, conformable to the decree of 1740, it being apparent by a survey made by the commissioners that the original line was north of west. This the Massachusetts commissioners refused to do, alleging that they were only empowered to ascertain and mark the original line.

On March 10, 1827, the legislature passed a resolution providing for the erection of durable monuments to preserve the boundary line between the States of Massachusetts and New Hampshire, as the same had been run and ascertained by the commissioners, and monuments were erected accordingly. (*Vide* Resolves of Massachusetts, 1827.)

In 1885 the joint commission appointed by the States of New Hampshire and Massachusetts re-ran and marked the curved portion of the boundary, following the course of Merrimac River, changing it only to a trifling extent. This commission was, however, unable to agree upon the boundary west of Pawtucket Falls. This matter dragged along until finally in 1894 this commission, together with a commission representing Vermont, agreed to maintain the Hazen line, and this line was re-traced and re-marked from Pawtucket Falls to the northwest corner of Massachusetts.

Under the decree of the King of 1740 the province of New Hampshire claimed jurisdiction as far west as the territory of Massachusetts and Connecticut extended, thus including the present State of Vermont. New York claimed all the country west of the Connecticut, under the charters of 1664 and 1674 to the Duke of York. A bitter controversy ensued. The following papers serve to throw some light on the matter:

Letter from the Governor of New Hampshire to the Governor of New York.

PORTSMOUTH, *November 17, 1749.*

* * * I think it my duty * * * to transmit to your excellency the description of New Hampshire as the King has determined it in the words of my commission. * * * In consequence of His Majesty's determination of the boundaries between New Hampshire and Massachusetts, a surveyor and proper chainmen were appointed to run the western line from 3 miles north of Pautucket Falls, and the surveyor upon oath has declared that it strikes Hudson's River about 80 poles north of where Mohawk's River comes into Hudson's River.

* * * * * * *

B. WENTWORTH.

(See State Papers of Vermont, Slade, 1, page 10.)

The following is a description of the bounds of New Hampshire given to Governor Benning Wentworth, of province of New Hampshire, by George II, July 3, 1741:

George the Second, by the Grace of God, of Great Britain, France, and Ireland King, Defender of the Faith, &c.

To our trusty and well-beloved Benning Wentworth, esqr., greeting:

Know you that we, reposing especial trust and confidence in the prudence, courage, and loyalty of you, the said Benning Wentworth, out of our especial grace, certain knowledge, and meer motion, have thought fit to constitute and appoint, and by these presents do constitute and appoint you, the said Benning Wentworth, to be our governor and commander-in-chief of our province of New Hampshire, within our dominions of New England in America, bounded on the south side by a similar curve line pursuing the course of Merrimac River at three miles distance, on the north side thereof, beginning at the Atlantick Ocean and ending at a point due north of a place called Pautucket Falls, and by a straight line drawn from thence due west cross the said river 'till it meets with our other Governments. * * *

Given at Whitehall July the 3rd, in the 15th year of His Majesty's reign.

(See Documentary History of N. York, vol. 4, page 331.)

The question of the right of territory was submitted to the King, who in 1764 made the following decree:

ORDER IN COUNCIL FIXING THE BOUNDARY BETWEEN NEW YORK AND NEW HAMPSHIRE.

[L. S.] AT THE COURT AT ST. JAMES,
The 20th day of July, 1764.

Present: The King's Most Excellent Majesty; Lord Steward, Earl of Sandwich, Earl of Halifax, Earl of Powis, Earl of Hilsborough, Mr. Vice Chamberlain Gilbert Eliot, Esqr., James Oswald, Esqr., Earl of Harcourt.

Whereas there was this day read at the Board a report made by the right honorable the lords of the committee of council for plantation affairs, dated the 17th of this instant, upon considering a representation from the lords commissioners for trade and plantations, relative to the disputes that have some years subsisted between the provinces of New Hampshire and New York, concerning the boundary line between those provinces, His Majesty, taking the same into consideration, was pleased with the advice of his Privy Council to approve of what is therein proposed, and doth accordingly hereby order and declare the western banks of the river Connecticut, from where it enters the province of the Massachusetts Bay, as far north as the forty-fifth degree of northern latitude, to be the boundary line between the said two provinces of New Hampshire and New York. Whereof the respective governors and commanders in chief of His Majesty's said provinces of New Hampshire and New York for the time being, and all others whom it may concern, are to take notice of His Majesty's pleasure hereby signified and govern themselves accordingly.

WM. BLAIR.

(*Vide* Documentary History of New York, vol. 4, p. 355.)

Notwithstanding this decree of the King, controversy, attended with violence, was kept up for many years; but the line was finally accepted and now forms the boundary line between the States of New Hampshire and Vermont.

The northern boundary of New Hampshire was settled by the United States and Great Britain. (*Vide* p. 18 *et seq.*)

It is as follows, viz:

Commencing at the "Crown Monument," so called, at the intersection of the State of New Hampshire, Maine, and the Province of Quebec, in latitude 45° 18′ 23″.33, longitude 71° 5′ 40″.5, thence in an irregular line to Hall's Stream, thence down the same to the northeastern corner of Vermont, in latitude 45° 0′ 17″.58, longitude 71° 30′ 34″.5. (*Vide* Hitch. Geology of New Hampshire.)

VERMONT.

The grants from King Henry, of France, of 1603, and King James, of England, of 1606, both included that territory which forms the present State of Vermont. It was also included in the charter of New England of 1620.

In the grants to the Duke of York, in 1664 and 1674, all the territory between the Connecticut and Delaware Rivers was included. New York, therefore, claimed jurisdiction of the territory now known as Vermont. Massachusetts, however, at an early period, having made claim to the tract west of the Connecticut River, now a portion of that State, by the interpretation of her charter, claimed the greater part of the same territory. By the terms of the charter of Massachusetts Bay, of 1629, that colony was granted all the lands—

> Which lye and be within the space of Three English myles to the northward of the saide River called Monomack alias Merrymack, or to the norward of any and every Parte thereof.

Under this clause Massachusetts Bay claimed that her jurisdiction extended 3 miles north of the farthest part of the Merrimac River, which would embrace a large portion of New Hampshire and Vermont. New Hampshire contested this claim, and after several years' controversy was more than sustained by a decision of the King in 1740. New Hampshire in her turn claimed the territory of Vermont, on the ground that Massachusetts and Connecticut, having been allowed to extend their boundaries to within 20 miles of the Hudson River, her western boundary should go equally as far, and contended that the King's decree of 1740 left that fairly to be inferred; also, that the old charters of 1664 and 1674 were obsolete.

By a decree of the King, however, the territory west of the Connecticut River, from the 45th parallel of north latitude to the Massachusetts line, was declared to belong to the province of New York. (*Vide* New Hampshire, p. 50.)

As most of the settlers of Vermont were from New Hampshire, this decision of the King caused great dissatisfaction, and the Revolution found Vermont the scene of conflicting claims, and the theatre of violent acts, culminating, in some instances, in actual bloodshed.

On January 15, 1777, Vermont declared herself independent and laid claim to the territory west as far as Hudson River, and from its source north to the international boundary, including a tract along the west shore of Lake Champlain. A part of New Hampshire, also, at one time, sought a union with Vermont.

In 1781 Massachusetts assented to her independence. She adjusted her differences with New Hampshire in 1782, but eight years more passed before New York consented to her admission into the Union.

In 1791 Vermont was admitted as an independent State, but was required to restrict her boundaries to their present extent.

The act of New York, of March 6, 1790, giving her consent to the admission of Vermont, defines her boundaries. (*Vide* Slade's Vermont, p. 507.)

The northern boundary was settled by the United States and Great Britain by the treaty of Washington, in 1842. (*Vide* p. 18.)

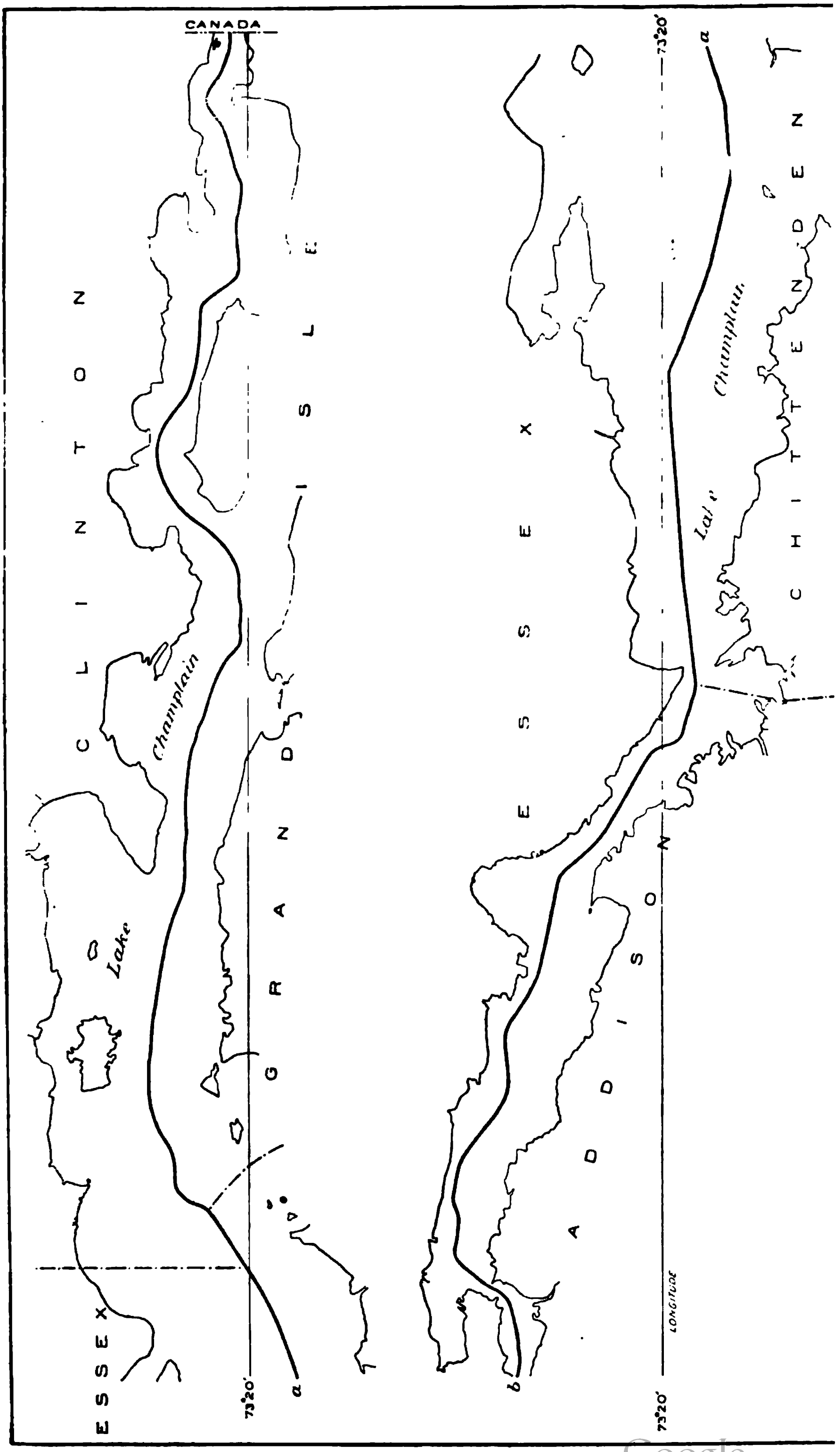
The eastern boundary is low-water mark on the west bank of the Connecticut River. (*Vide* New Hampshire, p. 50.)

The southern boundary was settled by the decree of 1740. (*Vide* New Hampshire, p. 48.)

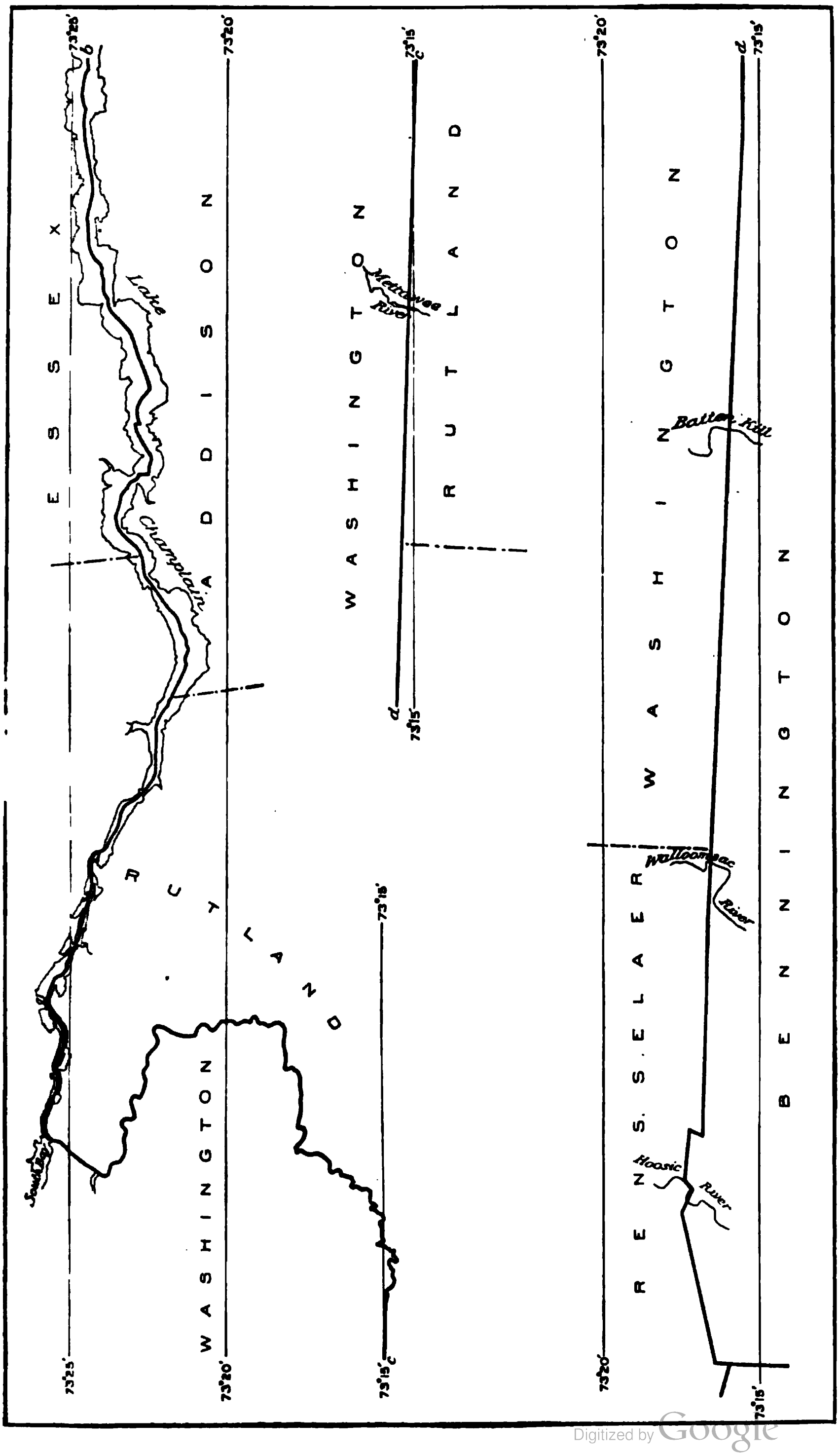
The line between Vermont and New York was surveyed and marked by commissioners from the two States in 1814, and is as follows, viz:

Beginning at a red or black oak tree, the northwest corner of Massachusetts, and running north 82° 20′ west as the magnetic needle pointed in 1814, 50 chains, to a monument erected for the southwest corner of the State of Vermont, by Smith Thompson, Simon De Witt, and George Tibbitts, commissioners on the part of New York, and Joseph Beeman, jr., Henry Olin, and Joel Pratt second, commissioners on the part of the State of Vermont, which monument stands on the brow of a high hill, descending to the west, then northerly in a straight line to a point which is distant 10 chains, on a course, south 35 degrees west, from the most westerly corner of a lot of land distinguished in the records of the town of Pownal, in the State of Vermont, as the fifth division of the right of Gamaliel Wallace, and which, in the year 1814, was owned and occupied by Abraham Vosburgh; then north 35 degrees east to said corner and along the westerly bounds of said lot, 30 chains to a place on the westerly bank of Hasick River, where a hemlock tree heretofore stood, noticed in said records as the most northerly corner of said lot; then north 1 degree and 20 minutes west, 6 chains to a monument erected by the said commissioners, standing on the westerly side of Hasick River, on the north side of the highway leading out of Hasick into Pownal, and near the northwesterly corner of the bridge crossing said river; then north 27 degrees and 20 minutes east, 30 chains, through the bed of the said river, to a large roundish rock on the northeasterly bank thereof; then north 25 degrees west, 16 chains and 70 links; then north 9 degrees west, 18 chains and 60 links, to a white-oak tree, at the southwest corner of the land occupied in 1814 by Thomas Wilsey; then north 11 degrees east, 77 chains to the north side of a highway, where it is met by a fence dividing the possession of said Thomas Wilsey, jr., and Emery Hunt; then north 46 degrees east, 6 chains; then south 66 degrees east, 26 chains and 25 links; then north 9 degrees east, 27 chains and 50 links to a blue-slate stone, anciently set up for the southwest corner of Bennington; then north 7 degrees and 30 minutes east, 46 miles 43 chains and 50 links to a bunch of hornbeam saplings on the south bank of Poultney River, the northernmost of which was marked by said last-mentioned commissioners, and from which a large butternut tree bears north 70 degrees west, 30 links, a large hard maple tree, south 2 chains and 86 links, and a white ash tree on the north side of said river, north 77 degrees east.

Which said several lines from the monument erected for the southwest corner of the State of Vermont were established by said last-mentioned commissioners, and were run by them, as the magnetic needle pointed, in the year 1814, then down the said Poultney River, through the deepest channel thereof to East Bay; then through the middle of the deepest channel of East Bay and the waters thereof to where the same communicate with Lake Champlain; then through the deepest channel of Lake Champlain to the eastward of the islands called the Four Brothers, and the westward of the islands called the Grand Isle and Long Isle, or the Two Heroes, and to the west-



BOUNDARY BETWEEN VERMONT AND NEW YORK.



BOUNDARY BETWEEN VERMONT AND NEW YORK.

ward of the Isle La Motte to the line in the 45th degree of north latitude, established by treaty for the boundary line between the United States and the British Dominions. (See Revised Statutes of New York, Banks & Brothers, sixth edition, Vol. I, pp. 122–123.)

This line was changed in 1876 by a cession of a small territory from Vermont to New York, described as follows, viz:

All that portion of the town of Fairhaven, in the county of Rutland, and State of Vermont, lying westerly from the middle of the deepest channel of Poultney River as it now runs, and between the middle of the deepest channel of said river and the west line of the State of Vermont as at present established. (Ratified by Congress April 7, 1880.)

MASSACHUSETTS.

The territory of Massachusetts was included in the first charter of Virginia, granted in 1606, (*Vide* Virginia p., 94) and in the charter of New England, granted in 1620, (*Vide* Maine p. 39.)

In 1628 the council of Plymouth made a grant to the governor and company of Massachusetts Bay in New England, which was confirmed by the King, and a charter was granted in 1629, of which the following are extracts:

* * * Nowe Knowe Yee, that Wee * * * have given and granted * * * all that Parte of Newe England in Amirica which lyes and extends betweene a great River there commonlie called Monomack River, alias Merrimack River, and a certen other River there, called Charles River, being in the Bottome of a certen Bay there, comonlie called Massachusetts alias Mattachusetts, alias Massatusetts Bay, and also all and singuler those Landes and Hereditament whatsoever, lying within the Space of Three Englishe Myles on the South Parte of the said River called Charles River, or of any or every Parte thereof. And also all and singuler the Landes and Hereditaments whatsoever, lying and being with the space of Three Englishe Miles to the southward of the southermost Parte of the said Baye, called Massachusetts, alias Mattachusetts, alias Massatusetts Bay—and also all those Lands and Hereditaments whatsoever, which lye and be within the space of Three English Myles to the Northward of the saide River, called Monomack, alias Merrymack, or to the Norward of any and every Parte thereof and all Landes and Hereditaments whatsoever, lyeing within the Lymitts aforesaide, North and South, in Latitude and Bredth, and in Length and Longitude, of and within all the Bredth aforesaide, throughout the Mayne Landes there from the Atlantick and Westerne Sea and Ocean on the East Parte, to the South Sea on the West Parte.

* * * Provided alwayes, That yf the said Landes * * * were at the tyme of the graunting of the saide former Letters patents, dated the Third Day of November, in the Eighteenth yeare of our said deare Fathers Raigne aforesaide, actuallie possessed or inhabited by any other Christian Prince of State, or were within the Boundes Lymitts or Territories of that Southern Colony, then before graunted by our saide late Father * * * That then this present Graunt shall not extend to any such partes or parcells thereof * * * but as to those partes or parcells * * * shal be vtterlie voyd, theis presents or any Thinge therein conteyned to the contrarie notwistanding * * *

The charter of New England was surrendered to the King in 1635. (*Vide* Plymouth Colony Laws, p. 333.)

The charter of 1629 was canceled by a judgment of the high court of chancery of England, June 18, 1684. (*Vide* C. & C., p. 942.)

In the year 1686, Pemaquid and its dependencies were annexed to the New England government. (*Vide* Maine, p. 40.)

In 1691 a new charter was granted to Massachusetts Bay, which included Plymouth Colony and the Provinces of Maine and Nova Scotia. The following are extracts from this charter:

* * * Wee * * * do will and ordeyne that the Territories and Collonyes Commonly called or Known by the names of the Collony of the Massachusetts Bay and Collony of New Plymouth the Province of Main the Territorie called Accadia or Nova Scotia and all that tract of Land lying betweene the said Territories of Nova Scotia and the said Province of Main be erected Vnited and Incorporated * * * into one reall Province by the Name of Our Province of the Massachusetts Bay in New England. * * *

All that parte of New England in America lying and extending from the greate River comonly called Monomack als Merrimack on the Northpart and from three Miles Northward of the said River to the Atlantick or Western Sea or Ocean on the South part And all the Lands and Hereditaments whatsoever lying within the limitts aforesaid and extending as farr as the Outermost Points or Promontories of Land called Cape Cod and Cape Mallabar North and South and in Latitude Breadth and in Length and Longitude of and within all the Breadth and Compass aforesaid throughout the Main Land there from the said Atlantick or Western Sea and Ocean on the East parte towards the South Sea or Westward as far as Our Collonyes of Rhode Island Connecticutt and the Narragansett Countrey all alsoe all that part or porĉon of Main Land beginning at the Entrance of Pescataway Harbour and soe to pass vpp the same into the River Newickewannock and through the same into the furthest head thereof and from thence Northwestward till One Hundred and Twenty miles be furnished and from Piscataway Harbour mouth aforesid North-Eastward along the Sea Coast to Sagadehock and from the Period of One Hundred and Twenty Miles aforesaid to crosse over Land to the One Hundred and Twenty Miles before reckoned up into the Land from Piscataway Harbour through Newickawannock River and alsoe the North halfe of the Isles and Shoales togather with the Isles of Cappawock and Nantukett near Cape Cod aforesaid and alsoe [all] Lands and Hereditaments lying and being in the Countrey and Territory comonly called Accadia or Nova Scotia And all those Lands and Hereditaments lying and extending betweene the said Countrey or Territory of Nova Scotia and the said River of Sagadahock or any part thereof And all Lands Grounds Places Soiles Woods and Wood grounds Havens Ports Rivers Waters and other Hereditaments and premisses whatsoever, lying within the said bounds and limitts aforesaid and every part and parcell thereof and alsoe all Islands and Isletts lying within tenn Leagues directly opposite to the Main Land within the said bounds. * * *

(For an account of the settlement of the boundary between the District of Maine, formerly a part of Massachusetts, see Maine, p. 41.)

The present northern boundary of Massachusetts was settled in 1741. (For history, see New Hampshire, p. 48.)

The boundary line between Massachusetts and Rhode Island was for more than two hundred years a question of dispute, and was, in some respects, the most remarkable boundary case with which this country has had to do. Twice the case went to the Supreme Court of the United States, and in one of these suits Daniel Webster and Rufus Choate were employed as counsel for Massachusetts.

As early as 1642 the line between the two colonies was marked in part by Nathaniel Woodward and Solomon Saffrey, who set up on the plain of Wrentham a stake as the commencement of the line between Massachusetts Bay and Rhode Island. This stake was by them supposed to mark a point 3 miles south of the Charles River.

The report of these commissioners has not been found, but frequent reference is made to their survey in the record of the subsequent controversies and litigations.

In 1710–'11 commissioners appointed from Massachusetts and Rhode Island agreed upon the north line of Rhode Island. The action of the commissioners was approved by the legislatures of both colonies.

The agreement was as follows, viz:

> That the stake set up by Nathaniel Woodward and Solomon Saffrey, skillful, approved artists, in the year of our Lord 1642, and since that often renewed in the latitude of 41° 55′, being 3 English miles distant southward from the southernmost part of the river called Charles River, agreeable to the letters patent for the Massachusetts Province, be accounted and allowed on both sides the commencement of the line between the Massachusetts and the colony of Rhode Island, from which said stake the dividing line shall run, so as it may (at Connecticut River) be 2¼ miles to the southward of a due west line, allowing the variation of the compass to be 9°; which said line shall forever, &c. (*Vide* Howard's Reports, S. C., Vol. 4, p. 631, *et seq.*)

In 1719 this line was run by commissioners appointed for the purpose. Subsequent investigation has shown that this line was run in a very irregular manner. (*Vide* R. I. Acts, May, 1867, page 6, *et seq.*)

The line between Massachusetts and the eastern part of Rhode Island was fixed by commissioners in 1741, from the decision of whom the colony of Rhode Island appealed to the King, who, in the year 1746, affirmed their decision by a royal decree.

The following is a record of the proceedings in council, together with the royal decree.

[Council Office. Council Register. Geo. II, No. 8, p. 204.]

AT THE COURT AT KENSINGTON
the 29th day of July 1742.

Present. The Kings Most Excellent Majesty, Archbp^{d} of Canturbury, Earl of Pembroke, Lord President Earl of Winchelsea, Lord Privy Seal Earl of Grantham, Duke of Bolton, Earl of Cholmondelly, Duke of Rutland, Earl of Wilmington, Marq^{s} of Tweedale, Earl of Bath, Visco^{t} Lonsdale, Mr. Chancellor of the Exche^{cr}, Lord Delaware, Sr Charles Wager, Lord Bathurst, Sr. William Younge, Lord Monsore, Sr John Norris, Mr Speaker Thomas Winnington Esq., Mr. Vice Chamberlin, George Wade Esq.

Upon reading this day at the board the humble Petetion and appeale of the Governor and company of the English of Rhode Island and Providence Plantations in New England in America from several particular parts of the determination of the commissioners appointed by his Majesty to settle the Boundary's of the said colony Eastwards with the Province of Massachusetts Bay, and humbly praying that a day may be appointed for hearing said appeal, and that the particular parts of the said commissioners determination appealed from may be reversed, and such other deter-

mination made instead thereof as shall be agreeable to the true construction of the Boundarys contained in the Royal Charter under which the Petioners claim, It is ordered by his Majesty in Council that the said Petition and appeal (a copy whereof is hereunto annexed). Be and it is hereby referred to the Right Honorable the Lord of the committee of council for hearing appeals from the Plantations to hear the same, and report their opinion thereupon to his Majesty at the Board.

A true copy.

I. B. LENNARD.

Collated with the original entry in the Council Register, 18 Jan'y, 1845.

ROBT. LEMON.

[Council Office. Council Register. Geo. II, No. 8 p. 285.]

At the Court of Kensington,
***the* 15*th day of Sept.* 1742.**

Present, The Kings most Excellent Majesty Archbp of Canturbury, Lord Delmar Lord Chancellor, Mr Vice Chamberlin, Duke of Richmond, Mr. Chancellor of the Exchequer, Duke of Newcastle, Harry Pelham Esq. Earl of Winchelsea, Thomas Winnington Esq Earl of Wilmington George Wade Esq. Lord Cartaret.

Upon reading this day at the Board the humble Petition and appeale of His Majesty's Province of the Massachusetts Bay in New England from the determination of the commissioners appointed by His Majesty to settle the Boundary of the Colony of Rhode Island Eastwards, with the said province of Massachusetts Bay and humbly praying that a day may be appointed for hearing the said appeale and that the determination of the said commissioners may be reversed, and such other determination made instead thereof as shall be agreeable to the petioners claim exhibited before the said commissioners—It is ordered by his Majesty in council that the said petition and appeale (a copy whereof is hereunto annexed) Be and it is hereby referred to the Right Honorable the Lords of the committee in council for hearing appeals from the Plantations to hear the same and report their opinion thereupon to His Majesty at the Board.

A true copy.

I. B. LENNARD.

Collated with the original entry in the Council Registry, 18 of Jan'y, 1845.

ROBT. LEMON.

[Ordered in Council, dated 28th May, 1746. Council office. Council Register. Geo. II, No. 10, p. 493.]

At the Court of Kensington,
the 28*th day of May* 1746.

Present the Kings Most Excellent Majesty in Council

Upon reading at the Board a Report from the Right Honourable the Lord of the committee of council for hearing appeals from the Plantations dated the 11th of December 1744 in the words following vizt.

Your Majesty having been pleased by Your Order in council of the 29th of July 1742 to refer unto this committee the humble petition and appeale of the Governor and company of the English Colony of Rhode Island and Providence Plantations in New England in America, from several particular parts of the determination of the commissioners appointed by your Majesty to settle the Boundarys of said colony eastwards with the Province of Massachusetts Bay and humbly praying that the particular parts of the said commissioners determination appealed from may be reversed, and such other determinations made instead thereof, as shall be agreeable to the true construction of the Boundarys continued in the Royal Charter under which the petitions claim—and your Majesty having been also pleased by another order in council of the 15th of September 1742, to refer unto this committee, the humble Petition and appeal of your Majesty's Province of the Massachusetts Bay in New England parte of the said determination of the said commissioners, and humbly praying that the same may be reversed and set aside and that instead thereof Your Majesty will be graciously pleased to give such judgement and determinations as shall be agreeable to the petitioners claim exhibited before the said commissioners. The Lords of the committee in obedience to your Majesty's said orders of Reference, have met several times, and taken both the said Petitions of Appeale into their consideration, and having examined into the Proceedings of the said commissioners, do find that they pronounced their judgements or determination on the 30th of June 1741 in the words following:

The court took into consideration, the charters, Deeds and other Evidences, Claims Pleas and allegations produced and made by party refering to the controversy before them and after mature advisement, came to the following Resolutions: That there is not any one Evidence proving that the Water between the Main Land on the East, and Rhode Island on the West, was ever at any time called Naragansett River, that though there be evidence that the place where the Indian called King Philip lived near Bristol, was called Pawconoket, and that another place near Swanzey was called Sowams or Sowamsett, yet no evidence has been produced of the extent of the Pawconoket country to Seaconk, or Pawtucket River, as it runs to the line of the late Colony of the Massachusetts Bay, for tho' there be some evidence that the Indians at enmity with King Philip, or with other Indians in enmity with him, lived on the west side of the said River, and that the Indians subject to King Philip, or in amity with him, lived on the East side of the said River there is no Evidence that all the Indians subject to, or in amity with King Philip, lived in the Pawconoket Country. That the Province not having produced the Letters Patent, constituting the council of Plymouth, nor any copy thereof, the Recital of said Letters Patent in the deed from the council of Plymouth, to Bradford and his associates, is not sufficient evidence against the Kings Charter. That the council of Plymouth being a Corporation, could not create another corporation, and that no Jurisdiction within the Kings Dominions in America can be held by Prescription or on the Foot of Prescription. That the determination of the boundarys of the colony's of Rhode Island and New Plymouth by the Kings Commissioners in the year 1664 appear to have been only a temporary order for preserving the Peace on the Borders of both Colonys without determining the Rights and Titles of either. Upon the whole nothing appears whereby the Colony of Rhode Island and Providence plantations can be barred or hindered from extending their Jurisdiction Eastward towards the Province of the Massachusetts Bay according to the true intents and meaning of their charter. But some dispute having arisen between the Partys as to the true construction and meaning thereof, the court is of opinion, That the Narragansett Bay is and extendeth itself from Point Judith in the west to Seaconet Point on the East and including the Islands therein, layeth and extendeth itself unto the mouth of the River which runnith towards the town of Providence and that as it so lies or extends, it has and may be considered as having one Eastern Side at the Eastern coast of the said Bay runs up northerly from Seconets Point,—and one other North Eastern Side from near Mount Hope to Bullocks Neck, as the said Bay runs up North Westerly towards the Town of Providence and that the land adjacent to the said North Eastern and Eastern Coasts and including within the following lines and the said Bay are within the Jurisdiction of the Colony of Rhode Island; Vizt on the North East side of the said Bay—one line running from the south west corner of Bullocks Neck, Northeast three Miles. One other line running from the Northeast extremity of the said line until it be terminated by a line three miles Northeast from the northeasternmost part of the Bay on the west side of Rumstick Neck, and one other line from the termination of the west line to the Bay at or near Towoset Neck, running so that it touch the North East extremity of a line running three miles North East from the North East corner of Bristol Harbour, and on the Eastern side of the said Bay; One line from a certain point on the Eastern side of the said Bay opposite to the southernmost part of the Shawmuts Neck, and four hundred and forty Rods to the Southwards of the Mouth of Fall River running East three miles; One other line running from the Easternmost extremity of the said line till it be terminated by the Easternmost end of a line three miles East from the Easternmost part of a cove in the said Bay which is to the southward of Nawquaket and one other line from the termination of the last line to the sea, running on such course as to be three miles East from the Easternmost part of the Bay adjoining to Scitchuwest on Rhode Island, and that the said Distances of three miles East and Northeast, are to be measured from high Water Mark, and this court doth hereby settle, adjust and determine, that the Eastern Boundary of the said Colony of Rhode Island and Providence Plantations, towards the Massachusetts Bay, is, shall be and runs from a certain Pointe (where a Meridian line passing through Pawtuckets Falls, cuts the South Boundary of the Colony of Massachusetts Bay), south to Pawtuckets Falls, Then southerly along the eastward side of Seaconk River, and the River which runnith towards the Town of Providence, to the Southwest corner of Bullock's Neck, then Northeast three miles; and then along the aforesaid lines running at three miles distance from the Easternmost parts of the said Bay to the said Bay, at or near Towoset Neck. Then as the said Bay runs to the southernmost point of Shawmuts Neck, and then in a straight line to the aforesaid point opposite to the said Neck. Then East three miles and then along the aforesaid lines, running at three miles distance from the Easternmost parts of the said Bay, to the sea. All which lines are to be run by making the proper allowance for the variation of the Magnetic Needle from the Meridian. And for the better understanding of the description of the lines before mentioned; the Court hath caused the Boundary lines of the lands adjacent to the said most eastern and Northeastern points of the Said Bay, to be delineated on the Map or Plan of the said Bay and countries adjacent now in court, and the same are distinguished on the said Map or Plan, by A, B, C, D, E, F, G, H.

The Lord of the Committee having considered the whole matter and heard all partys concerned therein by their Council learned in the Law, Do agree humbly to report to your Majesty as their opinion, That the said Judgment or determination of the said Commissioners should be affirmed, and both the Petitions of Appeal therefrom dismissed.

His Majesty this day took the said Report into consideration and was pleased with the advice of the Privy Council to approve thereof, and to order, that the said Judgment or Determination of the said Commmissioners, Be, and it is hereby Affirmed And both the said Petitions of Appeal therefrom dismissed.

Whereof the Governor or the Commander in Chief of His Majesty's Province of the Massachusetts Bay, The Governor and Company of the colony of Rhode Island and Providence Plantations for the time being, and all others whom it may concern, are to take notice and govern themselves accordingly.

A true Copy.

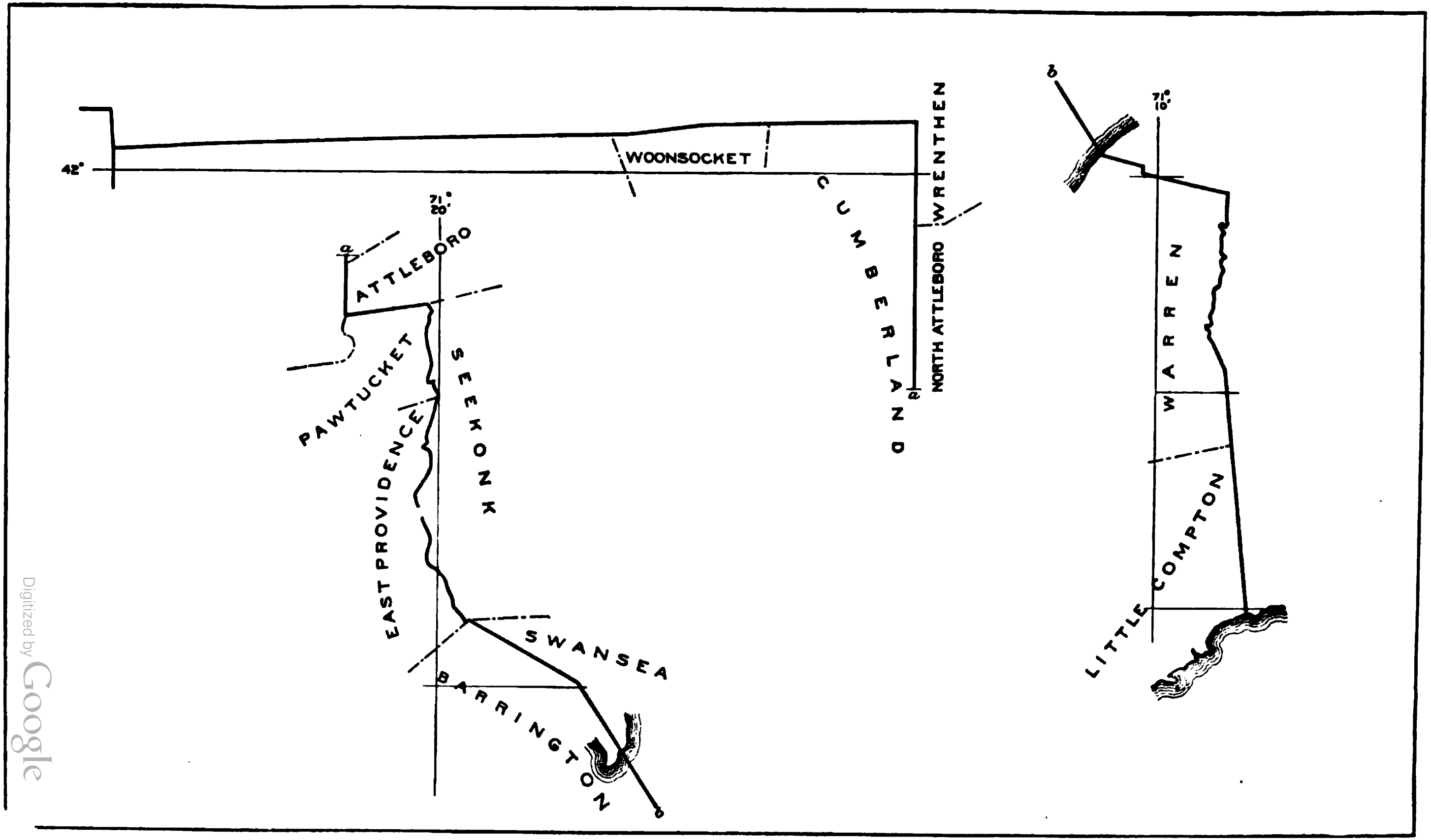
I B LENNARD.

Colated with the Original entry in the Council Register, 18 January, 1745.

ROBT LEMON.

Under the foregoing decree the line was run by commissioners appointed for the purpose, whose report was as follows, viz:

We, the subscribers, appointed commissioners by the general assembly of the colony aforesaid, to mark out the bounds of said colony eastward towards the province of Massachusetts Bay, agreeable to His Majesty's royal determination in council, the 28th day of May, 1746, did in pursuance thereof, on the second day of December last past, meet at Pawtucket Falls, in expectation of meeting with commissioners that might be appointed by the province of the Massachusetts Bay, for the purpose aforesaid; and after having there tarried till the afterpart of said day, and no commissioners in behalf of the said province appearing, we proceeded to run a due north line



BOUNDARY BETWEEN MASSACHUSETTS AND RHODE ISLAND.

from Pawtucket Falls to the south boundary of the aforesaid province of the Massachusetts Bay, in manner following, viz: From a certain point on the southern side of Pawtucket Falls, where we erected a monument of stones, with a stake thereon, we run a meridian line which directly passed through said falls, to a walnut tree on the northerly side of said falls; then to a pitch pine tree; then to a small white oak; then to a grey oak; then to a small bush; then to another small bush with stones about it; then to a heap of stones with a stake thereon; then to a black oak tree; then to another black oak; then to a small pitch pine; then to a black oak; then to a large white oak near the river, called Abbot's Run; then to a poplar tree; then to a heap of stones with a stake thereon; then to a large rock with stones thereon; then to a small black oak tree; then to a walnut tree; then to a black oak; then to divers other marked trees in the said course, to the extremity of said line; and when we came near the termination of the said line made a monument of stones, there being no noted south boundary of the said province near the said line, and therefore, for the discovery of the south boundary of the said province, upon the best information we could obtain, proceeded to Wrentham Plain, at or near to a place where was formerly erected a stake, called Woodward's and Saffery's stake, as one remarkable south boundary of the said province, and from thence run a west line, making an allowance of eight degrees and a half as the west variation of the magnetic needle from the true meridian, it being the course of the south line of the said province, according to their charter (as we apprehended), and then we extended the said north line from the aforesaid monument till it intersected the said west line, and upon the point of its intersection erected a monument of stones with a stake thereon, as the northeast boundary of that tract of land commonly called the Gore.

After which we proceeded to Bullock's Neck, and on the southeast corner thereof erected a red cedar post, marked with the letters J. H. C. R., with the figure of an anchor thereon, and from thence running a line northeast making the same allowance for the variation aforesaid, to a black oak tree marked with the letters G. C. C. R., then to a large white oak marked with the letters G. B. C. R., then to a white oak post, set in the ground with a heap of stones around it, marked with the letters G. W. C. R., with the figure of an anchor thereon, being three miles distant from Bullock's Neck aforesaid.

After which we proceeded to the northeasternmost part of the bay on the west side of Rumstick Neck, and from a point where a locust post was erected, run a line three miles northeast, with the same allowance for the variation and at the extremity of the said line erected a monument of stones, from which we run a line to the northeast extremity of that line drawn from the southwest corner of Bullock's Neck aforesaid, the course whereof being west thirty-eight degrees north, according to the magnetic needle, the distance of nine hundred and fifty-five rods, marking trees and making other boundaries in the course of said line. After which we proceeded to the northeast corner of Bristol Harbour, and from high-water mark, which was some rods distant northeast from the bridge leading to Swanzey Ferry, we ran a line three miles northeast, still making the same allowance for the variation, and at the extremity of which line we erected a monument of stones; then we ran a line from the northeast extremity of the line drawn from Rumstick aforesaid, the course whereof being south twenty-five degrees east, till it met with the termination of the line drawn from Bristol Harbour aforesaid, the distance whereof being nine hundred and twenty-seven rods; and from thence to a straight line to the bay at Towoset Neck, making proper boundaries in the course of said line.

After which we proceeded to the eastern side of the Narragansett Bay, and on the easternmost part of a cove in the said bay, which is southward of Nanequachet, ran a line three miles east (still making the same allowance for variation), at the extremity whereof we marked a grey oak tree with the letters C. R., with the figure of an anchor thereon.

After which we proceeded to the mouth of Fall River, and from thence measured four hundred and forty rods southerly on the shore, as the said shore extendeth itself from the mouth of said Fall River, and from the point where the said four hundred and forty rods reached, being east thirty-five degrees south of the southernmost point of Shawomet Neck, we ran a line three miles east, with the same allowance for the variation; in the course whereof we marked divers trees, and came to a large pond, on the west of which was a small oak between two large rocks, and from thence measured over the said pond to a bunch of maples, two whereof we marked with the letters I and F, standing on a place called Ralph's Neck, being the extremity of the said three miles; from thence we ran a line south twenty degrees west, two thousand one hundred and twenty-three rods (making proper boundaries in said line), till we met the termination of the three-mile line, ran from the cove southward of Nanequachet aforesaid.

After which we proceeded to a place called Church's Cove, in said bay, and ran a line three miles east, making the same allowance for the variation aforesaid, and at the extremity whereof, and near the sea, we erected a monument of stones, and from thence ran a line north two degrees and a quarter east, one thousand and nine hundred and forty-one rods, till it also met the termination of the said line, drawn from the first mentioned cove as aforesaid, making proper boundaries in the course of said line.

The aforegoing is a just account of our proceedings, and report the same accordingly.

J. HONEYMAN, Jr.
GEORGE WANTON.
GIDEON CORNELL.
GEORGE BROWN.

And it is voted and resolved, That the said report be, and it is hereby, accepted by this assembly.

In the year 1748 the legislature of Rhode Island appointed commissioners to continue the line to the Connecticut corner, recognizing the Woodward and Saffrey stake as the place of beginning. Massachusetts failed to appoint commissioners, whereupon the Rhode Island commissioners proceeded to complete the running of the line. In their report they say—

That we not being able to find any stake or other monument which we could imagine set up by Woodward and Saffrey, but considering that the place thereof was described in the agreement mentioned in our commission, by certain invariable marks, we did proceed as followeth, namely: We found a place where Charles River formed a large current southerly, which place is known to many by the name of Pappatalish Pond. which we took to be the southernmost part of said river, from the southernmost part of which we measured three English miles south, which three English miles did terminate upon a plain in a township called Wrentham. (See Howard's Reports S. C., vol. 4, page 632).

From this point they ran the line. From this time forward repeated steps were taken by Rhode Island by resolutions, and by appointment of commissioners at different times to ascertain and run the line, in connection with commissioners from Massachusetts; commissioners from both colonies met more than once, but they failed to agree upon a boundary in place of that established under the agreements of 1711-'18. Rhode Island alleged a mistake in her commissioners, in the place of beginning (that is, on Wrentham Plain), as the ground of these efforts.

This controversy, however, embraced the entire line from the State of

Connecticut to the Atlantic Ocean. Massachusetts asserted that an encroachment had been made on her territory from Burnt Swamp Corner to the ocean by Rhode Island, who, on her part, claimed that the jurisdictional line of Massachusetts from said corner to the Connecticut line was, in its whole extent, upon the territory of Rhode Island. The legislatures of the respective States having failed, after repeated effort, to adjust the controversy, Rhode Island in 1832, by a bill in equity, brought the subject of the northern boundary, from Burnt Swamp Corner to the Connecticut line, before the Supreme Court of the United States, which in 1846 decided that the jurisdictional line claimed by Massachusetts was the legal boundary of the two States between these points.

While this suit was pending an attempt was made to settle the long controversy by an amicable adjustment of the whole line from Connecticut to the ocean. Commissioners were appointed by both States in 1844 to ascertain and mark the true boundary from Pawtucket Falls to Bullock Neck. In 1845 the same commissioners were authorized to ascertain the line from Burnt Swamp Corner to the Atlantic Ocean.

In 1846, the equity suit having been decided, they were authorized "to erect suitable monuments at the prominent angles of the line, from the Atlantic Ocean to the northwest corner of Rhode Island, and at such other points on the line as may subserve the public convenience." A majority of said commissioners agreed upon a line and erected monuments in 1847.

The report of the joint commission was dated Boston, January 13, 1848.

The line so agreed upon as a boundary between Burnt Swamp Corner and the northwest corner of Rhode Island was a straight line, varying a little from the irregular jurisdictional line established by the decision of the Supreme Court, and is described in the joint report of the majority of the commissioners of January, 1848, as follows, viz:

> Begin at the northwest corner of Rhode Island, on Connecticut line, in latitude 42° 00′ 29″ north, and longitude 71° 48′ 18″ west of Greenwich, thence easterly in a straight line 21.512 miles to Burnt Swamp Corner, in Wrentham, being in latitude 42° 01′ 08″ and longitude 71° 23′ 13″.

Upon this line were placed twenty-seven monuments, exclusive of that at Burnt Swamp Corner.

The general assembly of Rhode Island, in May, 1847, ratified and established the line from the ocean to the Connecticut line, "to take effect and become binding whenever the said agreement and boundary line should be ratified by the State of Massachusetts." The legislature of Massachusetts did not ratify the said agreement and boundary line, but proposed another joint commission, which was agreed to.

The attempt made by these commissioners to settle the line having failed, Massachusetts commenced a bill in equity before the Supreme Court of the United States for an adjudication of the boundary line from Burnt Swamp Corner to the Atlantic Ocean.

In 1860 both States agreed upon a conventional line, and asked that a decree of the United States Supreme Court should confirm the same, which prayer was granted, and the line was thus finally established by a decree rendered in the December term, 1861, which is as follows, viz:

Beginning at Burnt Swamp Corner (so called), in Wrentham, in latitude 42° 01′ 08″ north, longitude 71° 23′ 13″ west of Greenwich, being the northeasterly corner of Rhode Island.

Thence in a straight line to the center of a stone monument in the division line, between Attleborough and Pawtucket, on the easterly bank of the Blackstone River, being in latitude 41° 53′ 36″ north, longitude 71° 23′ 14″ west.

Thence easterly, by the northerly line of the town of Pawtucket, to a point where said line intersects the highest water mark on the easterly side of Farmer's or Seven Mile River, which point is shown on accompanying sheet marked "A," and designated as "Bound No. 1," being in latitude 41° 53′ 54″ north, longitude 71° 20′ 40″ west.

From Bound No. 1 the line runs southerly, following the highest water mark on the easterly side of Farmer's or Seven Mile River, as designated in said sheet marked "A," to its junction with the highest water mark on the southerly and easterly side of Ten Mile River, at a point designated as "Bound No. 3."

From Bound No. 3 the line runs southerly, following the highest water mark on the southerly and easterly side of said Ten Mile River, as shown on sheet marked "A," to a point designated as "Bound No. 13," said last point being at the most southerly bend of Ten Mile River in said line of highest water mark.

The line of "highest water mark" as shown on sheet A is defined by offsets at right angles to straight lines shown on said plan in blue ink, from Bound No. 1, and passing through points designated as bounds numbered 2 to 13, inclusive.

From Bound No. 13 the line runs southeasterly, being a straight line to the center of a stone pier in the middle of Runnin's River, on the north side of the road leading by Luther's store.

Thence through the center or middle of said Runnin's River as the same is at low water at a point when such line intersects the dividing line between Barrington and Seekonk, being in latitude 41° 46′ 28″, longitude 71° 19′ 23″.

Thence northeasterly, following the dividing line between Barrington and Seekonk, to a point at the northerly extremity of the dividing line between Barrington and Swanzey, in latitude 41° 36′ 34″, longitude 71° 19′ 30″.

Thence in a straight line southeasterly to the center of a copper bolt in King's Rock, so called and well known, near an ancient monument on said King's Rock, being on the west side of the road leading from Warren to Swanzey. This point is in latitude 41° 45′ 22″.98, longitude 71° 16′ 35″.75.

From King's Rock the line follows the dividing line between Warren and Swanzey to Mount Hope Bay, running in a straight line southeasterly to a point on the Birch Swamp Farm, in latitude 41° 45′ 08″, longitude 71° 15′ 58″.5.

Thence in a straight line to Mount Hope Bay, passing through the center of a copper bolt in a bowlder, in line of extreme high water at Toweset, to low-water line of said bay. This bolt is in latitude 41° 42′ 45″.27, longitude 71° 13′ 54″.70.

From Toweset the line runs southeasterly, crossing Mount Hope Bay, to the westerly end of line dividing Fall River and Tiverton, where the same intersects low-water line of said Mount Hope Bay.

Thence easterly, following said dividing line between Fall River and Tiverton, passing through the middle of a town way on the north side of farm belonging to John Chase, and through the southerly end of Cool's Pond, in a line passing through the middle of a highway, eight rods wide.

Thence running southerly through the center of said eight-rod highway to a point in line with the stone wall on northerly side of farm of Edmund Estes. This wall is easterly of the Stafford road (so called.)

> Thence running easterly in line with said wall to a point in line of highest water mark on the westerly shore of South Watuppa Pond, which point is shown on accompanying sheet marked "B," and designated as "Bound A."
>
> From Bound A the line runs southerly, following the highest water mark on westerly side of South Watuppa Pond, and of Sawdy Pond, and of the streams connecting said ponds, as shown on said sheet marked "B," to a point designated as "Bound F," said last point being at the most southerly end of Sawdy Pond in said line of highest water mark.
>
> The line of "highest water mark" as shown on sheet B is defined by offsets at right angles to straight lines from Bound A, and passing respectively through points designated "B" to "F," inclusive, and on the South Watuppa Pond is also the line that would be traced by a level thirteen inches above a bolt in stone work on westerly side of waterway in gate-house of reservoir dam of Watuppa Reservoir Company, Quequechan River. On Sawdy Pond the highest water mark is the line that would be traced by the level of an iron bolt driven in west side of flume to sawmill at northerly end of said Sawdy Pond.
>
> From Bound F the line runs southeasterly, being a straight line to the monument known as "Joe Sanford's bound," being the center of a copper bolt in stone on land of Joseph Tripp, and is in latitude 41° 35′ 37″ longitude 71° 08′ 13″.
>
> From Joe Sanford's bound the line runs southerly, following the westerly line of the town of Westport to the Atlantic Ocean, passing easterly of Quicksand Pond through the center of a bound known as Peaked Rock, situated in latitude 41° 29′ 58″, longitude 71° 07′ 34″.
>
> The first point in this line southerly of Sanford's bound is on the north side of milldam at Adamsville, 85.58 feet easterly of straight line from Sanford's to Peaked Rock.
>
> The second is 113.94 feet easterly of said straight line, and is on the easterly side of road leading from Adamsville to the ocean.
>
> The third is 234.48 feet east of said straight line, on the road leading to Little Compton, by Philip Simmons' house.
>
> The whole of the line thus described is shown on a plan herewith presented, which, with Sketches A and B, is made a part of this report and attested.

It will be observed that the above decree of the United States Supreme Court makes no reference to the line from Burnt Swamp Corner to the Connecticut line.

It will also be remembered (*vide* p. 61) that the "line of 1848," so called, was ratified by Rhode Island and rejected by Massachusetts. In 1865 the legislature of Massachusetts took action in regard to this portion of the line, as follows, viz:

> *Resolved*, That the boundary line between the State of Rhode Island and the Commonwealth of Massachusetts, from the line of the State of Connecticut to Burnt Swamp Corner, begins at the northwest corner of the State of Rhode Island on the Connecticut line, in latitude 42° 00′ 29″ north, and longitude 74° 48′ 18″ west of Greenwich,[3] and runs in a straight line 21 add $\frac{448}{1000}$ miles to Burnt Swamp Corner, in Wrentham, being in latitude 42° 1′ 8″ and longitude 71° 23′ 13″.

This is the line agreed upon by the commissioners, called the "line of 1848," ratified at the time by Rhode Island, but rejected by Massachusetts.

The tardy ratification of the line by Massachusetts was, in its turn, rejected by Rhode Island, on the ground that the then recent settlement of the eastern boundary by the decree of the Supreme Court had so changed the aspect of the controversy that she could not consent to the adoption of the line of 1848 as her northern boundary.

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[3] This is a clerical error. "Longitude 74° 48′ 18″" should read "longitude 71° 48′ 18″." (*Vide* Borden's Tables, p. 64).

Thus the northern boundary of Rhode Island was left in abeyance, or rather left in the condition prescribed by the decision of 1846.

In June, 1880, the legislature of Rhode Island passed a resolution to remove the monuments of the "line of 1848" and erect monuments on the jurisdictional line.

In 1881 the legislature of Massachusetts took like action.

This jurisdictional line has the same termini as the line of 1848, but is a very irregular line, sometimes running north of a direct line and sometimes falling south of it [the extreme variations being 529.3 feet north of the line of 1848, and 129 feet south of the same.] A full and detailed description may be found in Rhode Island acts, May, 1867, p. 6 *et seq.*

Also, *vide* Senate Document No. 14, Massachusetts, 1848, for a full account of this controversy.

In 1713, commissioners from the Province of Massachusetts Bay and Colony of Connecticut settled a line between Massachusetts and Connecticut.

By this line certain northern frontier towns were given to Massachusetts, viz: Woodstock, Suffield, Enfield, and Somers. In 1749 the legislature of Connecticut passed a resolution that, inasmuch as the line had not been approved by the King, and that the two colonies had no legal right to transfer territory without the confirmation of the Crown, the contract was void, and these towns were again taken under the jurisdiction of Connecticut. Massachusetts appealed to the King, and the claims of Connecticut were fully established. (See Hollister's History of Connecticut, Vol. II.)

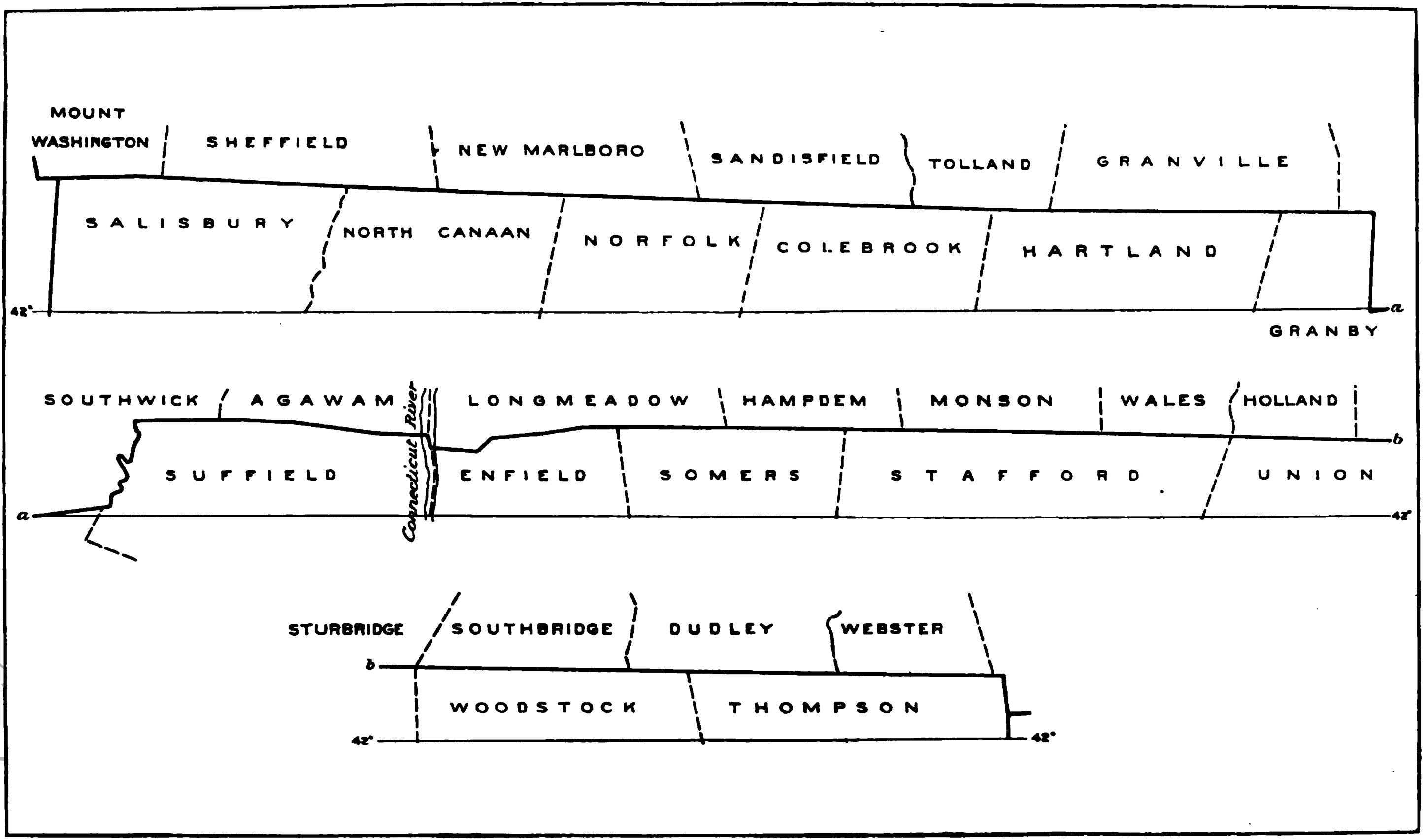
In 1791 Massachusetts and Connecticut appointed commissioners to establish the boundary between them, but they were unable to agree.

In 1803 commissioners were appointed to complete the line, a compromise having been made concerning the line between the town of Southwick and the towns of Suffield and Granby (the cause of the disagreement of the former commissioners).

The agreement made was as follows, viz:

> That the line should begin from a station 8 rods south of the southwest corner of West Springfield, and thence run west to the large ponds, and thence southerly by those ponds to the ancient south line of Westfield, and from thence on said south line to the ancient southwest corner of Westfield; and from thence northerly in the ancient west line of Westfield to the station in said west line made by commissioners in the year 1714, and from thence to the southwest corner of Granville. (See Mass Special Laws, Vol. III, page 234.)

In 1803 the commissioners surveyed and marked the boundary between their respective States.



BOUNDARY BETWEEN MASSACHUSETTS AND CONNECTICUT.

Their report, which was adopted, is as follows, viz:

Beginning at the northeast corner of Suffield and the southeast corner of West Springfield, on the west bank of Connecticut River, at a point 75 links northward of the center of a small valley running into said river, said point being between a small butternut tree, marked M. C., standing on the south, and a small crooked white oak, marked M., standing on the north, about two feet distant from each other, and then run north 82° 45′ west 1 chain to a stone monument erected by us there; in the same course 22 chains 25 links to a stone monument on the stage road from Springfield to Suffield, and said course continued would pass two feet north of Smith's house; thence north 82° west 82 chains 3 links to a stone monument on the middle road from Suffield to Springfield; then in the same course 13 chains 30 links to a large black or red oak tree, marked on the east side C., and on the west side M., being an ancient bound; thence north 77° 4′ west 134 chains 42 links to a stone monument on the road from Feeding Hills meeting-house to Suffield; thence in the same course 4 chains 21 links to a pine stump—an old monument; thence north 79° 48′ west 102 chains 80 links to a stone monument on the road from Westfield to Suffield, called the back street; thence north 81° 30′ west 61 chains 20 links to a stone monument at an old stump and stones, the ancient southwest corner of West Springfield; thence south 5° west 2 chains to a stone monument in the line run by commissioners in 1714; thence north 85° west 167 chains 33 links to a stone monument at the middle pond, 22 links east of low-water mark, being at the center of a little valley running into said pond; thence on the eastern shore of said pond, as the same runs southerly, to a sluice way or outlet from said pond to the south pond; thence southerly on the east shore of the south pond as the same runs to a stone monument at high-water mark on the south corner of said pond, being the south end of the most southerly bay thereof, from which the point of land beyond the bay on the east side of the pond bears north 29° east, and the high point beyond the bay on the west side of the pond is north 3° 30′ east; then south 10° 20′ west 24 chains 78 links to a stone monument at the southeast corner of Southwick, in the ancient south line of Westfield, from which the highest peak of Manatick Mountain bears south 42° 30′ west; thence south 87° 30′ west 33 chains 86 links to a heap of stones in a hedge, being an ancient monument in the south line of Westfield and the northwest corner of Suffield, adjoining Granby; thence in said ancient south line of Westfield the same course to a stone monument at a white oak stump, an old monument, the southwest corner of Southwick, being 174 chains 36 links; thence north 10° 20′ east 212 chains 84 links to a stone monument erected by us, at a place in the ancient west line of Westfield, where commissioners in 1714 established the monument called the Crank monument; thence north 82° 17′ west 137 chains to a stone monument erected by us at the east road from Granby to Granville; in this course, at the distance of 86 chains 20 links from the Crank monument, we passed between two pillars of stones 45 links south of one and 13 links north of the other, both said to be the southeast corner of Granville; thence on the same course 61 chains 40 links to a stone monument erected by us on the Granby turnpike road; thence in the same course 44 chains to a white-oak[4] tree, marked by commissioners in 1717, and which we marked M on the north side and C, 1803, on the south side; thence north 84° 24′ west 5 chains 13 links to a stone monument erected by us on the west road from Granby to Granville; thence in the same course 200 chains 37 links to a white elm stump and stones on the west bank of Valley Brook, so-called, a monument, made by commissioners in 1717 in this course three monuments are mentioned by said commissioners, which we do not find; thence north 85° 7′ west 60 chains 15 links to a stone monument erected by us at a new road near the east bank of Hubbard River; thence the same course 2 chains to dry hemlock tree with stones about it on the west side of said river near a small fall and a rock on the east side of said river stooping towards it more than 2 rods to a monument erected by said former commissioners; thence north 82° 52′ west 109 chains 35 links to a stone monument[5] erected by us on the road from Granville to Hartland; thence the same course 275 chains 91 links to a large heap of stones on the west bank of Slocum Brook between two hemlock trees, having many ancient and modern marks thereon, being a monument made by said former commissioners; in this course, the commissioners of 1717 made mention of a large hemlock tree, and a very large white-ash tree which we do not find; thence north 81° 50′ west 93 chains 74 links to a stone monument erected by us on the Beach-hill Road, so-called; thence in the same course 235 chains to a stone monument erected by us at a heap of stones about an elm tree standing on the west bank of Sandy Brook, a monument made by said former commissioners, who mentioned in their report a monument in this course, which we do not find; thence north 82° 11′ west 357 chains 30 links to a stone monument erected by us on the road from Marlborough to Norfolk; thence same course 38 chains 20 links to a monument made by said former commissioners on the west bank of Whiting River, near falls, being a heap of flat stones on a large rock; thence north 82° 9′ west 219 chains to a stone monument at the end of Greenwood Turnpike road; in this course said former commissioners marked two trees, which we do not find; thence in the same course 161 chains 75 links to a stone monument at the Burrell Road, so-called, leading from Canaan to Suffield; thence in the same course 49 chains to an elm tree, with stones near it, on the east bank of Housatonic River, about six rods west from a chestnut stump and stones, a monument made by said former commissioners, who also marked a white oak tree in this course which we not find; thence north 82° 52′ west 20 chains 50 links to a stone monument erected by us at the road leading from Salisbury to Sheffield, called Wetany Road; thence in the same course 119 chains 50 links to a stone monument erected by us at the road from Salisbury to Sheffield, near Ebenezer Fletcher's house; thence on the same course 211 chains 35 links to a stone monument erected by us at the mountain road from Salisbury to Sheffield; thence on the same course 28 chains 4 links to a monument established by said former commissioners at the foot of the mountain, being a heap of stones on a large rock, 20 links long on the northeasterly side, 5 feet high on the southerly side, and which we marked 1803 on the southerly side; thence north 85° 30′ west 147 chains 20 links to a stone monument erected by us on the road from Salisbury to Mount Washington; thence on the same course 81 chains 80 links to a large heap of stones, the oblong corner bounds, so-called between the State of Connecticut and New York.

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[4] Oak-tree boundary at Granville, marked in 1717.

* * * * * * *

The courses of said line as before given, and here by us are according to the present state of Magnetic needle, which we observed to vary 5° west of north. (See Private Laws of Conn., vol. 2, pages 1540 to 1544.)

ABSTRACT OF REPORT OF COMMISSION OF 1803 ON BOUNDARY BETWEEN MASSACHUSETTS AND CONNECTICUT WEST OF THE CONNECTICUT RIVER.

Beginning at a point on the west bank of Connecticut River, in latitude 42° 01′ 52″.10, longitude 72° 37′ 03″.46, and running north 82° 45′ west 22 chains 25 links; thence north 82° west 95 chains 33 links; thence north 77° 4′ west 138 chains 63 links; thence north 79° 48′ west 102 chains 80 links; thence north 81° 30′ west 61 chains 20 links; thence south 5° west 2 chains; thence north 85° west 167 chains 33 links to a stone monument at the middle pond, 22 links east of low-water mark, latitude 42° 02′ 11″, longitude 72° 45′ 45″.07; thence southerly along the east shore of said pond, and also south pond, to a stone monument at high-water mark, at the south corner of said south pond; thence south 10° 20′ west 24 chains 78 links to a stone monument at southeast corner of Southwick, which is in latitude 42° 00′ 11″.98, longitude 72° 46′ 24″.23; thence south 87° 30′ west 208 chains 22 links to a stone monument at the southwest corner of Southwick, which is in latitude 41° 59′ 51″.89, longitude 72° 49′ 25″.47; thence north 10° 20′ east 212 chains 84 links, to a stone monument at the northwest corner of the Southwick Jog, which is in latitude 42° 02′ 12″.39, longitude 72° 49′ 13″.51; thence north 82° 17′ west 242 chains 40 links to a white oak tree, marked by commissioners in 1717, which is in latitude 42° 02′ 15″.84, longitude 72° 52′ 47″.74; thence north 84° 24′ west 205 chains 50 links; thence north 85° 7′ west 62 chains 15 links; thence north 82° 52′ west 109 chains 35 links to a stone monument in latitude 42° 02′ 17″.03, longitude 72° 58′ 22″.52; thence north 82° 52′ west 275 chains 91 links; thence north 81° 45′ west 70 chains; thence north 81° 50′ west 328 chains 74 links to a stone monument, which is in latitude 42° 02′ 31″.11, longitude 73° 07′ 35″.94; thence north 82° 11′ west 395 chains 50 links; thence north 82° 9′ west 430 chains; thence north 82° 52′ west 140 chains to a stone monument on the road from Salisbury to Sheffield, which is in latitude 42° 02′ 58″.11, longitude 73° 22′ 55″.27; thence north 82° 52′ west 239 chains 39 links; thence north 85° 30′ west 239 chains to the northwest corner of Connecticut, which is in latitude 42° 02′ 58″.54, longitude 73° 30′ 06″.66.

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[5] Boundary stone in west front of Granville.

According to the survey of the cession of Boston Corners, by Massachusetts to New York, in 1855, the south boundary of Massachusetts from the northwest corner of Connecticut to the southwest corner of Massachusetts is as follows, viz:

A line running north 89° 08′ 4″ west, 40 chains, by the true meridian.

The courses of the line of 1803 are magnetic, with the variation as at that date: *i. e.*, 5° west.

The latitudes and longitudes in the foregoing are taken from the Borden Trigonometrical Survey of Massachusetts of 1843.

In 1826, the line between Massachusetts and Connecticut east of the Connecticut River was run by commissioners appointed from each State. An abstract of the commissioners' report is here given:

Abstract of report of commissioners of 1826.—The commissioners first made the following survey: Commencing at the northeast corner of Connecticut, at a large pile of stones erected by commissioners of 1734; thence running due west on the latitude of 42° 3′ north to the west line of Woodstock, 15 miles 169 rods 15 links. (This is hereafter referred to as the "first line of latitude.") Thence north 3° west 54 rods 19 links to an old pine tree, the reputed northeast corner of Union; thence due west 25 miles 168 rods to Connecticut River. (This line is hereinafter referred to as the "second line of latitude," and the second line of latitude is 54 rods north of the first.) These lines of latitude were compared with the ancient survey, monuments, evidence, etc., of the line run by the commissioners of 1713; the said lines of latitude were found to vary in sundry places therefrom. Therefore, in order to conform as near as possible to the line of 1713, the line was run as follows, viz:

Beginning at the northeast corner of Connecticut and running west on "first line of latitude" 1,702 rods and 4 links to the road to the Merino road; thence in a direct line 1,372 rods 20 links to the road leading from Muddy Brook, so called, by Pennel May's to Southbridge; this point is 21 rods 10 links north of the "first line of latitude"; thence in a direct line 360 rods 5 links to the Norwich and Woodstock turnpike (this point is 20 rods and 5 links north of "first line of latitude"); thence in a direct line 954 rods 18 links to the road leading from West Woodstock by Abel Mason's to Southbridge (this point is 10 rods and 22 links north of "first line of latitude"); thence in a direct line 1,247 rods to the road leading from Union by Asher Bodgen's to Holland (this point is 2 rods 14¾ links south of "second line of latitude"); thence in a direct line 1,127 rods to the turnpike from Hertford through Stafford and Holland to Worcester (this point is 6 rods 23½ links south of the "second line of latitude"); thence in a direct line 467 rods to an old white-oak tree, an ancient bound, on the road from Stafford by Robert Andruss' to South Brimfield (this point is 1 rod 2 links south of "second line of latitude"); thence in a direct line of 1,615 rods to the road leading from Stafford by Henry Cady's to Monson (this point is 16 rods 15 links south of "second line of latitude)"; thence in a direct line 256 rods to the Tracy road (this point is 12 rods 12 links south of "second line of latitude)"; thence in a direct line 620 rods to the road leading from Stafford by Seth Sheldon's to South Wilbraham (this point is 14 rods 7 links south of "second line of latitude"); thence in a direct line 1,066 rods to the road from Somer's by Walter Ainsworth's to Springfield (this point is 4 rods 1 link *north* of "second line of latitude"); thence in a direct line 523 rods to the road from Somer's by Abel Peas's to Springfield (this point is 6 rods 12 links south of the "second line of latitude"); thence *due west* 645 rods to the ancient line between Springfield (now Long Meadow) and Enfield; thence *south* 80° 30′ *west* by the true meridian 645 rods to a monument at an old oak stump; thence *south* 51° 30′ *west* by the true meridian 164 rods 18 links to a monument at an old pine stump; thence *due west* 349 rods 15 links to a monument on the Connecticut River 12 rods from the shore; thence due west to Connecticut River. On the line are erected 49 monument stones, marked on the north side M and on the south side C.

The commissioners also surveyed and marked the line from the the corner of Connecticut to the corner of Rhode Island, reporting as follows:

> Beginning at the monument erected at the northeast corner of said State of Connecticut and running in a direct line to the ancient heap of stones on the north side of the turnpike leading from Hertford to Boston through Thompson and Douglass, where we erected a monument, and thence running in a direct line to the northwest corner of the State of Rhode Island.

(For survey of 1826, see Private Laws of Conn., vol. 2, pages 1544 to 1550.)

The boundary between Massachusetts and New York at an early period became a subject of bitter dispute, New York claiming to the west bank of the Connecticut River under the charters of 1664 and 1674 to the Duke of York, Massachusetts claiming under her old charters to the South Sea. After many fruitless attempts at a settlement, an arrangement was entered into in 1773 fixing the western boundary of Massachusetts where it meets New York territory. The Revolution following soon after, the line was not run. In 1785 Congress appointed three commissioners to run the line, who performed that duty in 1787. The line was as follows, viz:

> Beginning at a monument erected in 1731 by commissioners from Connecticut and New York, distant from the Hudson River 20 miles, and running north 15° 12′ 9″, east 50 miles 41 chains and 79 links, to a red or black oak tree marked by said commissioners, which said line was run as the magnetic needle pointed in 1787. (*Vide* Revised Statutes of New York, 1875, p. 122.)

The claims of Massachusetts to western lands were finally settled December 16, 1786, by a joint commission of the two States. By this agreement Massachusetts surrendered the sovereignty of the whole disputed territory to New York, and received in return the right of soil and pre-emption right of Indian purchase west of the meridian passing through the eighty-second mile-stone of the Pennsylvania line, excepting certain reservations upon Niagara River. The title to a tract known as "The Boston Ten Towns," lying east of this meridian, previously granted by Massachusetts, was also confirmed. (*Vide* Hough's N. Y. Gaz., 1872, pp. 25, 26.)

April 19, 1785, Massachusetts executed a deed to the United States. It included all title of the State of Massachusetts to territory west of the present western boundary of New York.

In 1820 Maine, hitherto a part of Massachusetts, was admitted into the Union as an independent State.

In 1853 a small portion of territory in the southwestern corner of Massachusetts, known as Boston Corner, was ceded to New York, and the cession confirmed by Congress in 1855.

The cession of Boston Corner to New York changes the boundary, so that it is now as follows, viz:

Beginning at a monument erected in 1731 by commissioners from Connecticut and New York (known as the Connecticut monument), standing in the south boundary of Massachusetts, latitude 42° 02′ 58″.54, longitude 73° 30′ 06″.66, which is the northwest corner of the State of Connecticut; thence along the south boundary of Massachusetts, north 89° 08′ 41″ west, 40 chains; thence north 12° 57′ 16″ west 207.49^5 chains to a marble post marked on the east side M. S., on the west side N. Y., and on the south side 1853, which is in the line run by United States commissioners in 1787; thence north 15° 12′ 9″ east on the line run by said United States commissioners ([6]47 miles 73.70^5 chains) to a red or black oak tree marked by said United States commissioners, in the south boundary of the State of Vermont, latitude 42° 44′

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[6] This distance has been obtained by subtracting the length of the west line of Boston Corner given in survey of 1853 from the entire length of west boundary of Massachusetts as given by the United States commissioners in 1787.

45″.58, longitude 73° 16′ 17″.68. [See Revised Statutes of New York, 1875, page 122; also plat of survey of Boston Corner in 1853, a copy of which is on file in office of clerk of House of Representatives at Washington, D.C.]

RHODE ISLAND.

The present State of Rhode Island was settled by Roger Williams and other immigrants, who left Massachusetts Bay and established themselves at Providence in 1636.

In 1643 a patent was granted for the Providence Plantation, from which the following are extracts, viz:

* * * * * * *

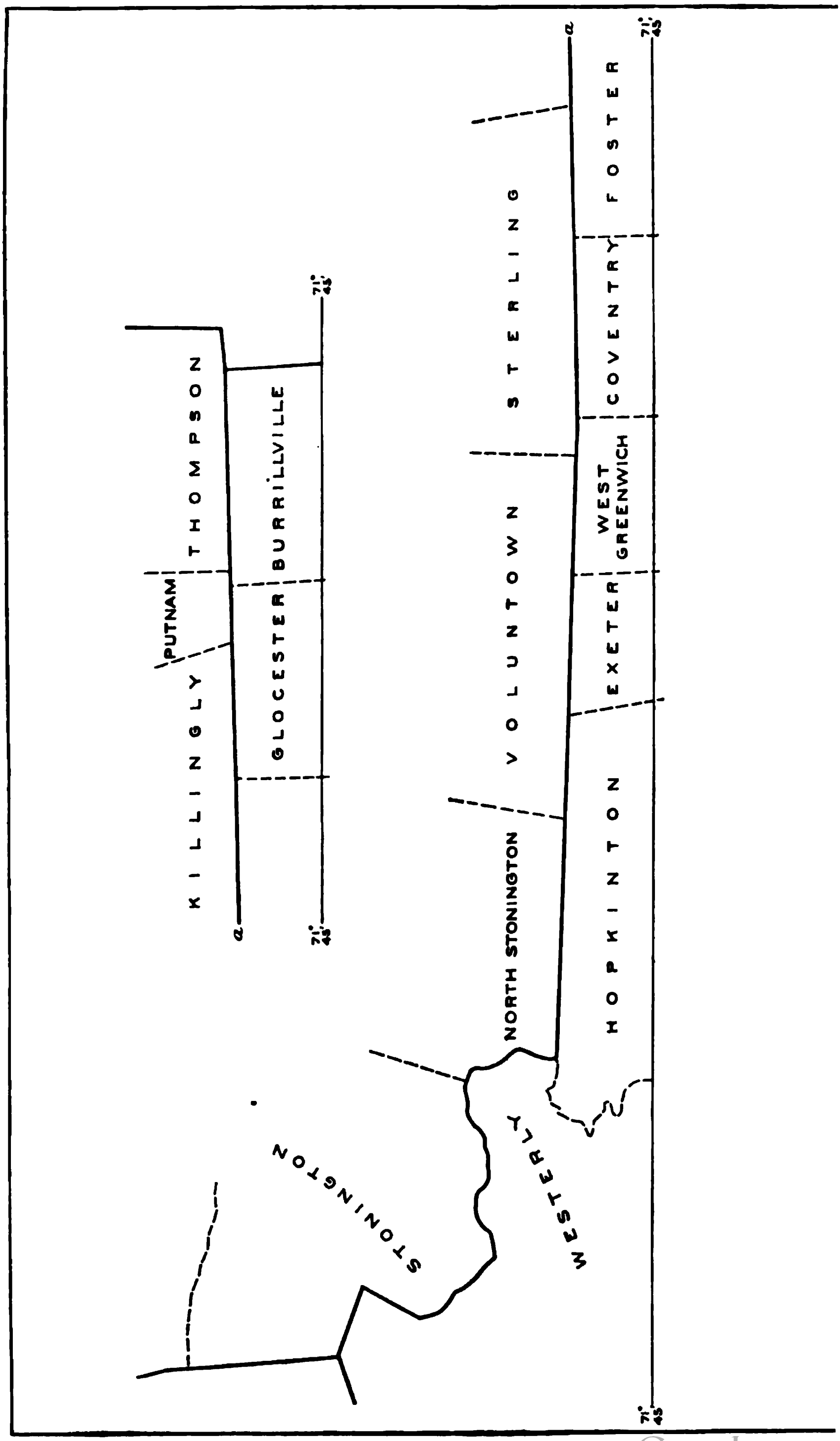
> And wheras there is a tract of land in the continent of America aforesaid, called by the name of the Narraganset Bay, bordering northward and northeast on the patent of the Massachusetts, east and southeast on Plymouth patent, south on the ocean, and on the west and northwest by the Indians called Nariggannencks, alias Narragansets, the whole tract extending about 25 English miles unto the Pequot River and country; and wheras divers English inhabitants of the towns of Providence, Portsmouth, and Newport, in the tract aforesaid, * * * have represented their desire, * * * we * * * do * * * give, grant, and confirm to the aforesaid inhabitants of the towns of Providence, Portsmouth, and Newport a firm and absolute charter of incorporation, to be known by the name of the incorporation of Providence Plantations, in the Narraganset Bay, in New England. * * *

In 1663 Charles II granted a charter to Rhode Island and Providence Plantations, of which the following is an extract:

> * * * "All that parte of our dominiones in New-England, in America, conteyneing the Nahantick and Narragansett Bay, and countryes and partes adjacent, bounded on the west, or westerly, to the middle or channel of a river there, commonly called and known by the name of Pawcatuck, alias Pawcawtuck river, and soe along the sayd river, as the greater or middle streame thereof reacheth or lyes upp into the north countrye, northward, unto the head thereof, and from thence, by a streight lyne drawn due north untill itt meets with the south lyne of the Massachusetts Collony; and on the north, or northerly, by the aforesayd south or southerly lyne of the Massachusetts Collony or Plantation, and extending towards the east, or eastwardly, three English miles to the east and north-east of the most eastern and north-eastern parts of the aforesayd Narragansett Bay, as the sayd bay lyeth or extendeth itself from the ocean on the south, or southwardly, unto the mouth of the river which runneth towards the towne of Providence, and from thence along the eastwardly side or banke of the sayd river (higher called by the name of Seacunck river), up to the ffalls called Patuckett ffalls, being the most westwardly lyne of Plymouth Collony, and soe from the sayd ffalls, in a streight lyne, due north, untill itt meet with the aforesayd line of the Massachusetts Collony; and bounded on the south by the ocean." And in particular, the lands belonging to the townes of Providence, Pawtuxet, Worwicke, Nusquammack, alias Pawcatuck, and the rest upon the main land in the tract aforesayd together with Rhode Island, Blocke Island, and all the rest of the islands and banks in the Narragansett Bay and bordering upon the coast of the tracts aforesaid (Ffishers Island only excepted). * * *

(For history of the northern and eastern boundaries see Massachusetts, p. 54.)

In 1703 substantially the present western boundary was settled by an agreement made between the commissioners from the two colonies of Rhode Island and Connecticut, viz: "A straight line from the mouth



BOUNDARY BETWEEN RHODE ISLAND AND CONNECTICUT

of Ashawoga River to the southwest corner of the Warwick purchase, and thence a straight north line to Massachusetts.

The line of 1703 was actually run by Rhode Island, and is still known as the Dexter and Hopkins line.

The two colonies disagreeing, Rhode Island appealed to the King, and the agreement of 1703 was finally established in 1726.

In September, 1728, commissioners from the two colonies met and ran the line.

(For agreement of 1703 and 1728, decisions of English council, etc., see R. I. Hist. Soc. Coll., Vol. III.)

In 1839 commissioners were appointed by Rhode Island and Connecticut to survey and ascertain the line and erect monuments.

The following line was established, viz:

> Beginning at a rock near the mouth of Ashawoga River, where it empties into Pawcatuck River, and from said rock a straight course northerly to an ancient stone heap at the southeast corner of the town of Voluntown, and from said rock southerly in the same course with the aforesaid line, until it strikes Pawcatuck River. From the southeast corner of Voluntown a straight line to a stone heap at the southwest corner of West Greenwich; from thence a straight line to the southwest corner of the ancient town of Warwick, and which is now a corner of the towns of Coventry and West Greenwich; from thence a straight line to the northwest corner of the town of Coventry; thence a straight line to the northeast corner of Sterling; thence a straight line to the southwest corner of Burrillville, and thence a straight line to a stone heap upon a hill in the present jurisdictional line between the States of Massachusetts and Rhode Island, and at all of said corners, excepting said Warwick corner, we have erected monuments of stone, marked R. I. and C., and have also placed similar monuments on all the principal roads crossing the line, and at other suitable places.
>
> * * * * * * *
>
> And we have caused the ancient monument which was erected at the Warwick corner in November, 1742, to be reset and a large heap of stones to be made around it. Said monument is marked with the letter C. on one side, and on the other RHODE. ISLAND and the traces of other letters and figures. [Extract from Commissioner's Report. See R. I. Acts and Resolves, Jan. 1846, pages 12, 13, 14.]

The above was ratified in 1846.

CONNECTICUT.

The title by which the people of Connecticut held the country was founded on the old patent granted by Robert, Earl of Warwick, in 1631, to Lord Say and Seal, Lord Brooke, Sir Richard Saltonstall, and others, associated under the name of the Plymouth Company.

In 1630 the Plymouth Council made a grant of Connecticut to the Earl of Warwick, their president. This was confirmed by King Charles in 1631, and on the 19th of March, in the same year, the Earl conveyed his title to the Plymouth Company, as before stated. (Dwight's Conn., p. 19, *et seq.*)

A charter was granted by Charles II to Connecticut in 1662, of which the following is an extract, viz:

* * * * * * *

> We * * * do give, grant and confirm unto the said Governor and Company, and their successors, all that part of our Dominions in New England in America bounded on the east by Narraganset River, commonly called Narraganset Bay, where the said river falleth into the sea, and on the north by the line of the Massachusetts plantation; and on the south by the sea; and longitude as the line of the Massachusetts Colony, running from east to west, that is to say, from the said Narragansett Bay on the east, to the south sea on the west part, with the islands thereunto adjoining. * *
>
> * * * * * * *
>
> [C. and C., p. 256–7.]

Previous to this time the two colonies of Connecticut and New Haven had continued separate, but under this charter they were united and the charter was accepted April 20, 1665. (C. and C., p. 252.)

The Duke of York having been granted a charter in 1664, by which the lands west of the Connecticut River were embraced in his jurisdiction, the question of boundary immediately arose.

About this time Col. Richard Nichols, George Cartwright, esq., Sir Robert Carr, and Samuel Maverick, esq., had been appointed commissioners by the King, and clothed with extraordinary powers, to determine all controversies in the colonies. The matter was referred to them, who, after a full hearing, determined that the southern boundary of Connecticut was the sea (Long Island Sound), and its western, Mamaroneck River, and a line drawn north-northwest from the head of salt water in it to Massachusetts. The territory south and west of these lines was declared to belong to the Duke of York. (*Vide* Dwight's Connecticut, pp. 159 *et seq.*)

This decision, in effect, decided upon a line 20 miles east of the Hudson River as the boundary, having for a starting point a place on Mamaroneck River.

In 1674 the Duke of York received a new charter in substantially the same terms as that of 1664. New controversies concerning jurisdiction led to a new agreement, by which it was stipulated that a tract of land on Long Island Sound, the bounds of which were described as containing 61,440 acres, should be permanently set off to Connecticut by New York on condition that the former, in exchange, should set off to New York a territory of like extent and of uniform width from the tract on the Sound to the south line of Massachusetts. This agreement was sanctioned by a royal ordinance of the King, and in 1684 the tract on the Sound was surveyed and set off to Connecticut.

The western boundary of Connecticut was run in 1685 by Major Gould, Mr. Barr, and Mr. Selleck, and ratified by both parties. (*Vide* Dwight's Connecticut, p. 199.)

For various reasons the survey of the equivalent lands was not made at that time.

In 1725 commissioners were appointed on both sides to fix the line, this being the fifth set appointed for the same purpose, none of which had been able to come to an agreement.

The commissioners of 1725, however, entered into articles of agreement settling the manner of the survey. They, however, ran only the line bounding the tract on Long Island Sound.

For some cause action was then suspended until 1731, when the commissioners of 1725 surveyed and set off the oblong or equivalent territory to New York, defining and marking its boundary, which was to remain forever the dividing line between the respective States (then colonies). The line was substantially as at present, and is as follows, viz:

> Beginning at Lyon's Point, in the mouth of a brook or river called Byram's River, where it falls into Long Island Sound, and running thence up along said river to a rock at the ancient road or wading-place in said river, which rock bears north twelve degrees and forty-five minutes east, five hundred and fifty rods from said point; then north twenty-three degrees and forty-five minutes west, two thousand two hundred and ninety-two rods; then east-northeast, thirteen miles and sixty-four rods, which lines were established in the year one thousand seven hundred and twenty-five, by Francis Harrison, Cadwaller Colden, and Isaac Hicks, commissioners on the part of the then province of New York, and Jonathan Law, Samuel Eells, Roger Walcott, John Copp, and Edmund Lewis, commissioners on the part of the then colony of Connecticut, and were run as the magnetic needle then pointed; then along an east-northeast continuation of the last-mentioned course, one mile, three-quarters of a mile, and twenty-one rods, to a monument erected in the year one thousand seven hundred and thirty-one by Cadwaller Colden, Gilbert Willett, Vincent Matthews, and Jacobus Bruyn, jr., commissioners on the part of said province, and Samuel Eells, Roger Walcott, and Edmund Lewis, commissioners on the part of said colony, which said monument is at the southeast corner of a tract known and distinguished as the oblong or equivalent lands; then north twenty-four degrees and thirty minutes west, until intersected by a line run by said last-mentioned commissioners, on a course south twelve degrees and thirty minutes west, from a monument erected by them in the south bounds of Massachusetts, which monument stands in a valley in the Taghkanick Mountains, one hundred and twenty-one rods eastward from a heap of stones in said bounds, on the top or ridge of the most westerly of said mountains; then north twelve degrees and thirty minutes east from a monument erected by said last-mentioned commissioners at said place of intersection, and standing on the north side of a hill, southeasterly from the easternmost end of the long pond, along the aforesaid line to the aforesaid monument erected in the south bounds of Massachusetts—being the northeast corner of the oblong. (See Revised Statutes of N. Y., 1881, Vol. I, pages 128-9.)

For more than a century no controversy arose, but subsequent to 1850 questions of jurisdiction were raised, and in 1855 Connecticut made a proposition for a new survey. Several sets of commissioners were appointed, but no agreement being reached, finally, in 1860, pursuant to an act of the legislature of New York, the line was run by the New York commissioners, Connecticut not being represented.

The first section of the act of the New York legislature is as follows, viz:

> 1. The commissioners appointed by the governor to ascertain the boundary line between the States of New York and Connecticut are hereby empowered and directed

to survey and mark, with suitable monuments, the said line between the two States *as fixed by the survey of* 1731.

The following is an abstract of the engineer's report of the line run under direction of the commissioners from New York, the Connecticut commissioners declining to be present or assist, viz:

Beginning at the northwest corner of Connecticut, at the monument erected by the commissioners of New York and Connecticut in 1731, latitude 42° 02′ 58″.54, longitude 73° 30′ 06″.66; thence south 11° 20′ west, 464 chains, to the [7]47th mile monument; thence south 12° 34′ west, 239 chains, 57 links, to the 44th mile monument point; thence south 11° 33′ west, 160 chains 99 links, to the 42d mile monument; thence south 13° 16′ west, 161 chains 24 links, to the 40th mile monument point; thence south 12° 21′ west, 398 chains 21 links, to the 35th mile monument; thence south 12° 32′ west, 158 chains 96 links, to the 33d mile monument; thence south 11° 44′ west, 243 chains 37 links, to the 30th mile monument; thence south 12° 27′ west, 161 chains 32 links, to the 28th mile monument; thence south 10° 56′ west, 160 chains, to the 26th mile monument point; thence south 11° 39′ west, 320 chains 11 links, to the 22d mile monument; thence south 12° 18′ west, 163 chains 17 links, to the 20th mile monument; thence south 11° 49′ west, 159 chains 9 links, to the 18th mile monument; thence south 12° 19′ west, 157 chains 15 links, to the 16th mile monument; thence south 10° 11′ west, 161 chains 7 links to the 14th mile monument; thence south 10° 51′ west, 313 chains 41 links, to the 10th mile monument point; thence south 12° 24′ west, 155 chains 71 links, to the 8th mile monument; thence south 10° 19′ west, 159 chains 28 links, to the 6th mile monument point; thence south 12° 10′ west, 164 chains 42 links, to the 4th mile monument; thence south 11° 44′ west, 158 chains 99 links, to the 2-mile monument; thence south 14° 10′ west, 109 chains 41 links, to the Ridgefield angle monument;[8] thence south 25° 8′ east, 213 chains 39 links, to the 4th mile monument on the east line of the oblong between the Wilton and Ridgefield angles; thence south 24° 48′ east, 157 chains 63 links, to the 2-mile monument; thence south 24° 14′ east, 167 chains 28 links, to the Wilton angle monument, or southeast corner of the oblong as set off by the commissioners of 1731; thence south 67° 45′ west, 138 chains 76 links, to the southwest corner of the oblong, and being where the survey of 1725 terminated; thence south 65° 44′ west, 90 chains 87 links, to a point considered the original 12th mile monument point; thence south 66° 56′ west, 241 chains 93 links, to a point called the 9th mile monument; thence south 66° 45′ west, 319 chains 12 links, to the 5th mile monument point; thence south 66° 25′ west, 398 chains 40 links, to the angle at the Duke's

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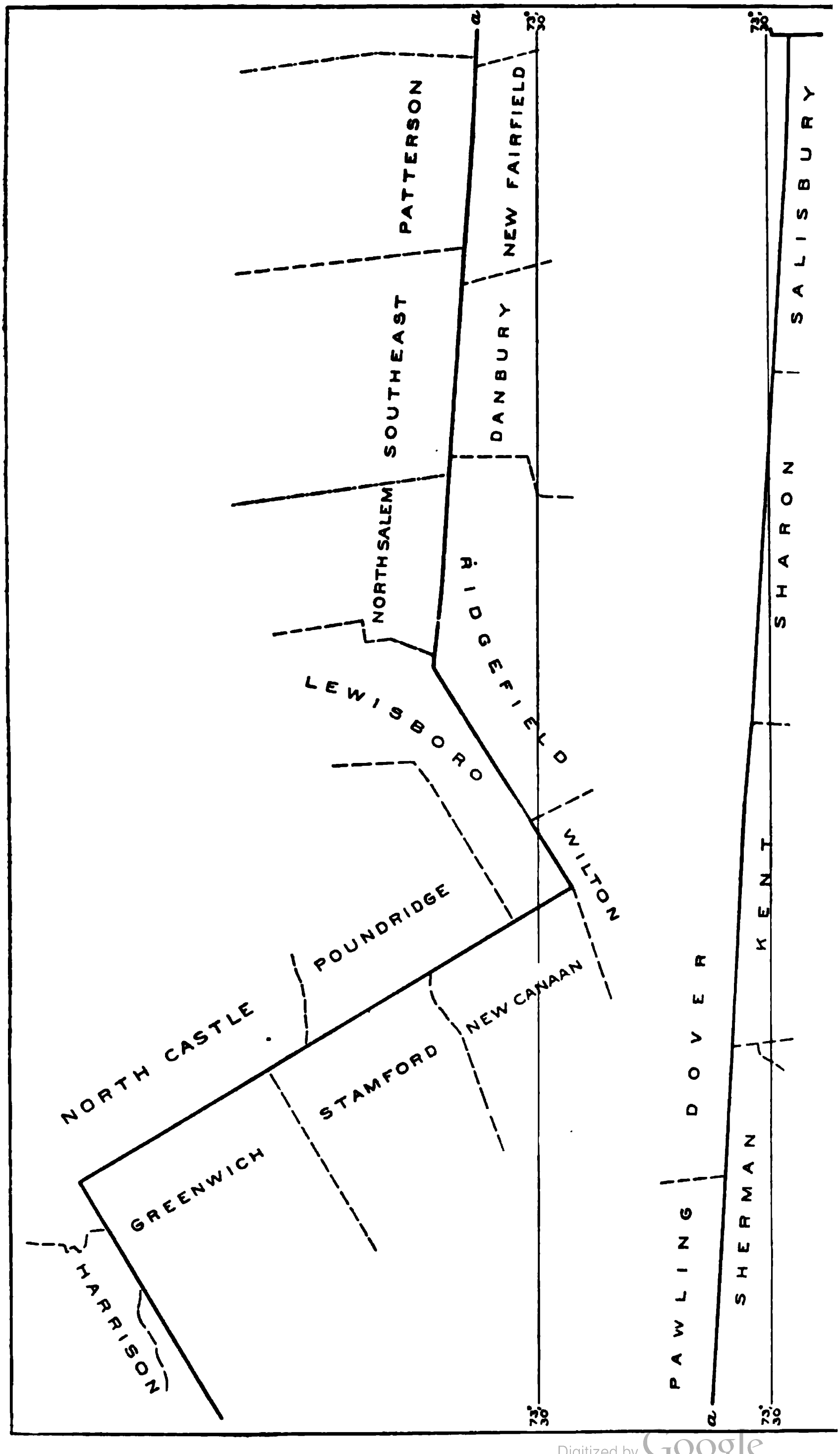
[7] The mile monuments referred to are those, at that time remaining, which were established by the Connecticut and New York commissioners of 1731.

[8] The entire distance from the Massachusetts line to Ridgefield angle is 52 miles 35 rods, a difference of only 5 rods from the survey of 1731.



BOUNDARY BETWEEN CONNECTICUT AND NEW YORK.

Trees; thence south 23° 38′ east, 172 chains 93 links, to a point which is west-southwest and distant 32 rods from the chimney in the old Clapp house; thence south 24° 21′ east, 224 chains 78 links, to a point opposite the old William Anderson house; thence south 24° 19′ east, 173 chains 7 links, to the great stone at the ancient wading place on Byrom River; thence south 17° 45′ west, 12 chains 60 links, to a rock in the river which can be seen at low tide, in which there is a bolt; thence south 27° west, 55 chains 19 links; thence south 7° 20′ east, 13 chains 45 links; thence south 12° 10′ east, 16 chains 13 links; thence south 2° 40′ east, 9 chains 4 links; thence south 28° 25′ east, 9 chains 54 links; thence south 18° 40′ east, 4 chains 77 links; thence south 11° 55′ west, 6 chains 33 links; thence south 58° 10′ west, to where it falls into the sound. (See report of the commissioners to ascertain and settle the boundary line between the States of New York and Connecticut, February 8, 1861, in which will also be found a complete account of this controversy.)

In 1880 commissioners were appointed by Connecticut and New York. Their report was ratified in 1880.

These commissioners reported as follows, viz:

> We agree that the boundary on the land constituting the western boundary of Connecticut and the eastern boundary of New York shall be and is as the same was defined by monuments erected by commissioners appointed by the State of New York, and completed in the year 1860, the said boundary line extending from Byram Point, formerly called Lyon's Point, on the south, to the line of the State of Massachusetts on the north.
>
> And we further agree that the boundary on the sound shall be and is as follows: Beginning at a point in the center of the channel, about 600 feet south of the extreme rocks of Byram Point, marked No. 0, on appended United States Coast Survey chart; thence running in a true southeast course 3½ statute miles; thence in a straight line (the arc of a great circle) northeasterly to a point 4 statute miles due south of New London Light-House; thence northeasterly to a point marked No. 1, on the annexed United States Coast Survey chart of Fisher's Island Sound, which point is on the longitude east three-quarters north, sailing course down on said map, and is about 1,000 feet northerly from the Hommock or North Dumpling Light-House; thence following said east three-fourths north sailing course as laid down on said map, easterly to a point marked No. 2 on said map; thence southeasterly to a point marked No. 3 on said map; so far as said States are coterminous. (See Revised Statutes of New York, 1881, Vol., I, page 136.)

The above agreement concerning these boundaries between Connecticut and New York was confirmed by the Congress of the United States on February 26, 1881. (See Revised Statutes of United States, 1881.)

(For the history and present location of the eastern boundary of Connecticut, *vide* Massachusetts, p. 61, and Rhode Island, p. 70. For the northern boundary, *vide* Massachusetts, p. 64.)

Under the charter of 1662 Connecticut claimed a large western territory. Subsequent to the Revolution, however, in 1786, 1792, 1795, and 1800, she relinquished all title to any land west of her present boundary.

NEW YORK.

The territory included in the present State of New York was embraced in the French and English grants of 1603 and 1606. The Dutch, however, in 1613 established trading posts on the Hudson River and claimed jurisdiction over the territory between the Connecticut and Delaware Rivers, which they called New Netherlands. The government was vested in "The United New Netherland Company," chartered in 1616, and then in "The Dutch West India Company," chartered in 1621.

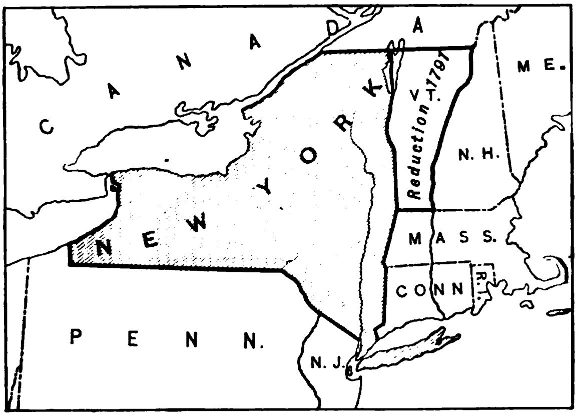
In 1664 King Charles II of England granted to his brother, the Duke of York, a large territory in America, which included, with other lands, all that tract lying between the west bank of the Connecticut River and the east bank of the Delaware. The Duke of York had previously purchased, in 1663, the grant of Long Island and other islands on the New England coast, made in 1635 to the Earl of Stirling, and in 1664, with an armed fleet, he took possession of New Amsterdam, which was thenceforth called New York. This conquest was confirmed by the treaty of Breda, in 1667.

The following is an extract from the grant of 1664 to the Duke of York:

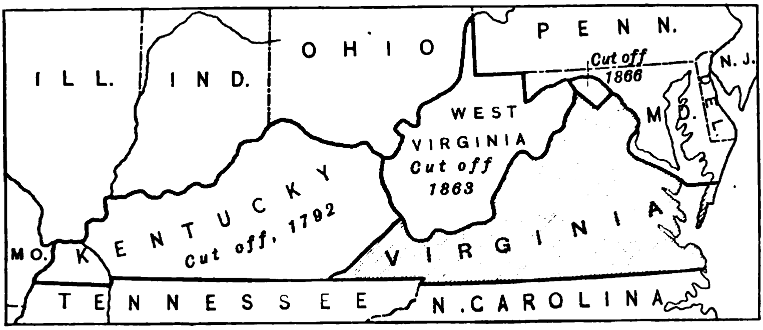
> All that parte of the maine land of New England beginning at a certaine place called or knowne by the name of St. Croix next adjoyning to New Scotland in America and from thence extending along the sea coast unto a certain place called Petuaquine or Pemaquid and so up the River thereof to the further head of ye same as it tendeth northwards and extending from thence to the River Kinebequi and so upwards by the shortest course to the River Canada northward and also all that Island or Islands commonly called by the severall name or names of Matowacks or Long Island scituate lying and being towards the west of Cape Codd and ye narrow Higansetts abutting upon the maine land between the two Rivers there called or knowne by the severall names of Conecticutt and Hudsons River togather also with the said river of Hudsons River and all the land from the west side of Conecticutt to ye east side of Delaware Bay and also all those severall Islands called, or knowne by the names of Martin's Vinyard and Nantukes otherwise Nantuckett togather with all ye lands islands soyles harbours mines minerals quarryes woods marshes waters lakes ffishings hawking hunting and ffowling and all other royalltyes proffitts commodityes and hereditaments to the said severale island lands and premisses belonging and appertaining with theire and every of theire appurtenances and all our estate right title interest benefitt advantage claime and demand of in or to the said lands and premisses or any part or parcell thereof and the reversion and reversions remainder and remainders togather with the yearly and other ye rents revenues and proffitts of all and singular the said premisses and of every part and parcell thereof to have and to hold all and singular the said lands islands hereditaments and premisses with their and every of their appurtenances.

In July, 1673, the Dutch recaptured New York and held it until it was restored to the English by the treaty of Westminster, in February, 1674.

The Duke of York thereupon, to perfect his title, obtained a new



HISTORICAL DIAGRAM OF NEW YORK.



HISTORICAL DIAGRAM OF VIRGINIA.

grant, in substantially the same terms as that of 1664 (C. and C., p. 1328), of which the following is an extract, viz:

* * * * * * *

> All that part of the main land of New England, beginning at a certain place called or known by the name of Saint Croix nexe adjoining to New Scotland in America, and from thence extending along the sea-coast into a certain place called Petuaquim or Pemquid, and so up the river thereof to the furthest head of the same as it windeth northward and extending from the river of Kinebequ and so upwards by the shortest course to the river Canada northwards; and all that island or islands commonly called by the several name or names of Matowacks or Long Islands, situate and being toward the west of Cape Cod and the narrow Higansuts abutting upon the main land between the two rivers there called or known by the several names of Connecticut and Hudson Rivers, together also with the said river called Hudson's River, and all the lands from the west side of Connecticut River to the east side of Delaware Bay; and also all those several islands called or known by the names of Martin Vinyard and Nantukes, otherwise Nantuckett.

* * * * * * *

By these grants to the Duke of York and the conquest of the Dutch possessions in America, it will be seen that New York originally had a claim to a much larger territory than is now included in her limits. The successive changes in her extent may be sketched as follows, viz:

In 1664 the Duke of York sold the present State of New Jersey to Lord John Berkeley and Sir George Carteret.

In 1682 the Duke of York sold to William Penn his title to Delaware and the country on the west bank of the Delaware, which had been originally settled by the Swedes, then conquered by the Dutch, and which had by them been surrendered to the Duke of York.

In 1686 Pemaquid and its dependencies were annexed to the New England government by a royal order, the Duke of York having acceded to the throne of England.

By the charter of 1691 to Massachusetts Bay, all claim to any part of Maine was extinguished, and the islands of Nantucket, Marthas Vineyard, and others adjacent (hitherto known as Duke's County, New York), were annexed to Massachusetts Bay.

The territory west of the Connecticut River to within about 20 miles of the Hudson River, now forming a portion of Massachusetts and Connecticut, were, by agreements and concessions made at various periods, surrendered to those States respectively.

In 1781 New York released to the General Government all the lands to which she had claim west of a meridian extending through the west extremity of Lake Ontario, and in 1790 she gave up all claim to the present State of Vermont and consented to her independence.

By these successive reductions New York was left with substantially her present boundaries.

(For the history and settlement of the eastern boundary of New York, *vide* Vermont, Massachusetts, and Connecticut, *ante* pp. 52, 68, and 72.)

The northern boundary was settled by the treaty of peace in 1783 and by the commission under the sixth article of the treaty of Ghent. (*Vide* p. 13.)

The boundary between New York and New Jersey was plainly stated in the grant by the Duke of York to Berkeley and Carteret. (*Vide* New Jersey, p. 82.)

In 1719 attempts were made to have the line run and marked, but nothing seems to have been done to settle the matter permanently till 1769, when commissioners were appointed by the King, who fixed on substantially the present line. (*Vide* R. S. N. J., 1821, pp. 29–34.)

In 1772 this line was confirmed by the legislatures of both colonies, and commissioners were appointed to survey and mark the same.

This line was as follows, viz:

A direct and straight line from the fork or branch formed by the junction of the stream or waters called the Machackamack with the river Delaware or Fishkill, in the latitude of 41° 21′ 37″, to a rock on the west side of the Hudson River, marked by the said surveyors in the latitude of 41°—said rock was ordered to be marked—with the following words and figures, viz: "Latitude 41° north;" and on the south side thereof "New Jersey"; and on the north side thereof "New York"; also, to mark every tree that stood on the line with five notches and a blaze on the northwest and southeast sides thereof, and to put up stone monuments, at 1 mile distance from each other, along the said line, and to number such monuments with the number of miles; the same shall be from the before-mentioned marked rock on the west side of Hudson's River, and mark the words "New Jersey" on the south side, and the words "New York" on the north side, of every of the said monuments. (See R. S. of N. J., 1821, pp. 29–34.)

The above was confirmed by the king in council September 1, 1773.

In the year 1833 commissioners were appointed by New York and New Jersey for the settlement of the territorial limits and jurisdiction of the two States.

In the following year the commissioners made the following agreement, which was ratified by each State and confirmed by Congress, viz:

UNITED STATES STATUTES AT LARGE. TWENTY-THIRD CONGRESS, SESSION I. 1834.

AN ACT giving the consent of Congress to an agreement or compact entered into between the State of New York and the State of New Jersey, respecting the territorial limits and jurisdiction of said States.

ARTICLE FIRST. The boundary line between the two States of New York and New Jersey, from a point in the middle of Hudson River, opposite the point on the west shore thereof, in the forty-first degree of north latitude, as heretofore ascertained, and marked, to the main sea, shall be the middle of the said river, of the bay of New York, of the waters between Staten Island and New Jersey and of Raritan Bay, to the main sea; except as hereinafter otherwise particularly mentioned.

ARTICLE SECOND. The State of New York shall retain its present jurisdiction of and over Bedloe's and Ellis's Islands, and shall also retain exclusive jurisdiction of and over the other islands lying in the waters above mentioned and now under the jurisdiction of that State.

ARTICLE THIRD. The State of New York shall have and enjoy exclusive jurisdiction of and over all the waters of Hudson River lying west of Manhattan Island and to the south of the mouth of Spuytenduyvel Creek; and of and over the lands covered by the said waters to the low-water mark on the westerly or New Jersey side thereof; subject to the following rights of property and of jurisdiction of the State of New Jersey, that is to say:

1. The State of New Jersey shall have the exclusive right of property in and to the land under water lying west of the middle of the bar of New York, and west of the middle of that part of the Hudson River which lies between Manhattan Island and New Jersey.

2. The State of New Jersey shall have the exclusive jurisdiction of and over the wharves, docks, and improvements made and to be made on the shore of the said State; and of and over all vessels aground on said shore, or fastened to any such wharf or dock, except that the said vessels shall be subject to the quarantine or health laws, and laws in relation to passengers, of the State of New York, which now exist or which may hereafter be passed.

3. The State of New Jersey shall have the exclusive right of regulating the fisheries on the westerly side of the middle of said waters: *Provided*, That the navigation be not obstructed or hindered.

ARTICLE FOURTH. The State of New York shall have exclusive jurisdiction of and over the waters of the Kill Von Kull between Staten Island and New Jersey to the westernmost end off Shorter's Island in respect to such quarantine laws, and laws relating to passengers, as now exist or may hereafter be passed under the authority of that State, and for executing the same; and the said State shall also have exclusive jurisdiction, for the like purposes, of and over the waters of the sound from the westermost end of Shorter's Island to Woodbridge Creek, as to all vessels bound to any port in the said State of New York.

ARTICLE FIFTH. The State of New Jersey shall have and enjoy exclusive jurisdiction of and over all the waters of the sound between Staten Island and New Jersey lying south of Woodbridge Creek, and of and over all the waters of Raritan Bay lying westward of a line drawn from the light-house at Prince's Bay to the mouth of Mattavan Creek; subject to the following rights of property and of jurisdiction of the State of New York, that is to say:

1. The State of New York shall have the exclusive right of property in and to the land under water lying between the middle of the said waters and Staten Island.

2. The State of New York shall have the exclusive jurisdiction of and over the wharves, docks, and improvements made and to be made on the shore of Staten Island, and of and over all vessels aground on said shore, or fastened to any such wharf or dock; except that the said vessels shall be subject to the quarantine of health laws, and laws in relation to passengers of the State of New Jersey which now exist or which may hereafter be passed.

3. The State of New York shall have the exclusive right of regulating the fisheries between the shore of Staten Island and the middle of said waters: *Provided*, That the navigation of the said waters be not obstructed or hindered.

* * * * * * *

In 1876 commissioners were appointed to re-locate the land boundary between New York and New Jersey, and replace monuments that may have become dilapidated or removed, or to erect new ones, etc. (*Vide* Rev. of N. J., 1877.)

The above commissioners found in some cases a slight discrepancy between the original marks and the verbal description thereof, and the legislatures of each State ordered that the original monuments should be considered the true boundary. (*See* acts of New York, 1880, and acts of New Jersey, 1881.)

In 1881 a joint commission of the two States was appointed for the purpose of retracing and remarking, in a permanent manner, this boundary. This work was completed in a thorough manner in 1883.

In 1887 a joint commission of the two States was appointed to determine and mark the boundary between the two States, through Raritan Bay. This commission came to an agreement, the terms of which are as follows:

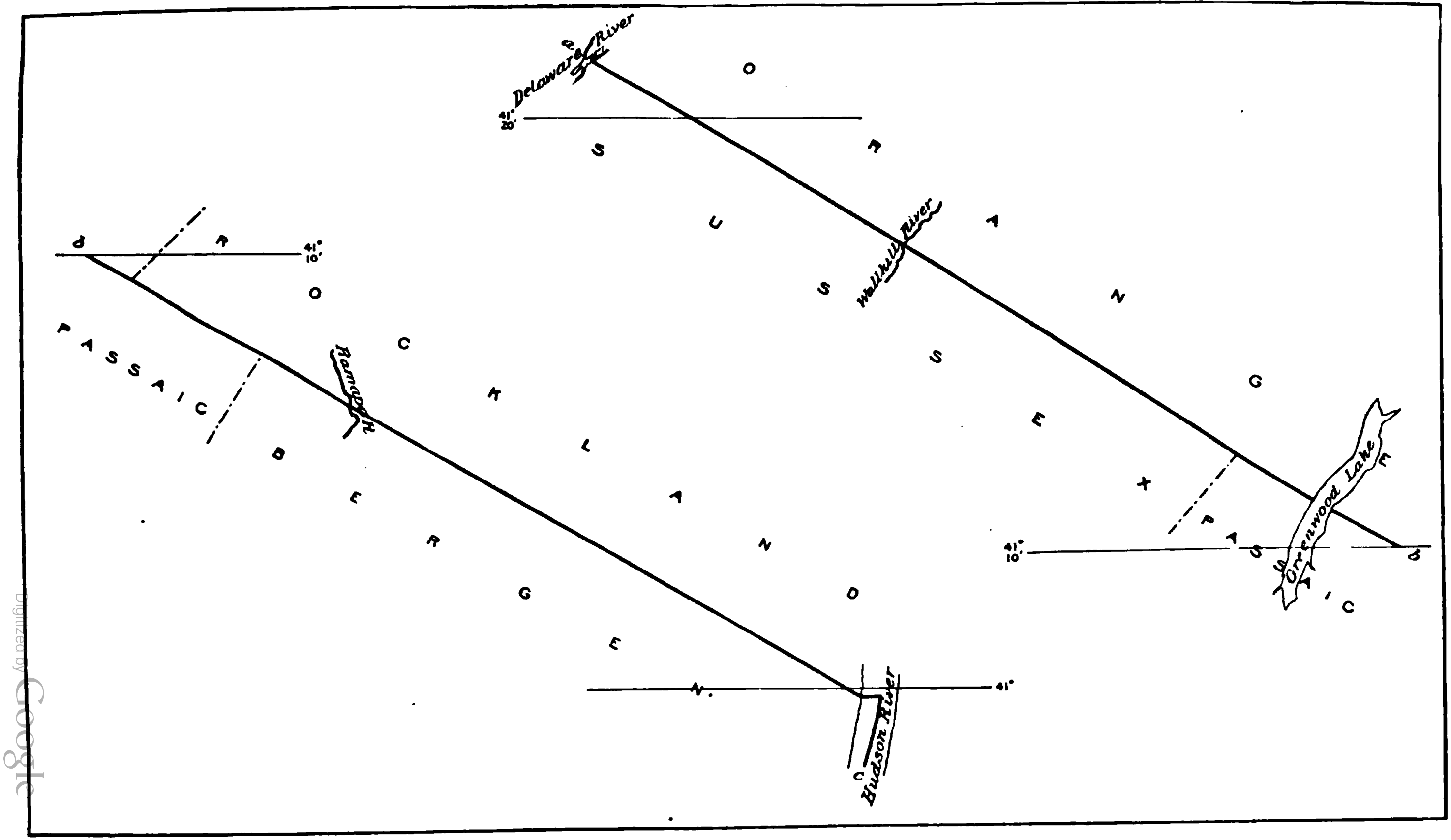
First. From "Great Beds light-house," in Raritan Bay, north, twenty degrees sixteen minutes west, true, to a point in the middle of the waters of Arthur Kill, or Staten Island Sound, equidistant between the southwesterly corner of the dwelling house of David C. Butler, at Ward's Point, on Staten Island, in the State of New York, at the southeasterly corner of the brick building on the lands of Cortlandt L. Parker, at the intersection of the westerly line of Water street with the northerly line of Lewis street, in Perth Amboy, in the State of New Jersey.

Second. From "Great Beds light-house" south, sixty-four degrees and twenty-one minutes east, true (S. 64° 21′ E.), in line with the center of Waackaack or Wilson's beacon, in Monmouth County, New Jersey, to a point at the intersection of said line with a line connecting "Morgan No. 2" triangulation point, U. S. Coast and Geodetic Survey, in Middlesex County, New Jersey, with the "Granite and Iron beacon," marked on the accompanying maps as "Romer stone beacon," situated on the "Dry Romer shoal;" and thence on a line bearing north, seventy-seven degrees and nine minutes east, true (N. 77° 9′ E.), connecting "Morgan No. 2" triangulation point, U. S. Coast and Geodetic Survey, in Middlesex County, New Jersey, with said "Romer stone beacon" (the line passing through said beacon and continuing in the same direction), to a point at its intersection with a line drawn between the "Hook beacon," on Sandy Hook, New Jersey, and the triangulation point of the U. S. Geodetic Survey, known as the Oriental Hotel, on Coney Island, New York; then southeasterly, at right angles with the last mentioned line to the main sea.

Third. The monumental marks by which said boundary line shall be hereafter known and recognized are hereby declared to be as follows:

1. The "Great Beds light-house."
2. A permanent monument marked "State boundary line New York and New Jersey," and to be placed at the intersection of the line drawn from the "Great Beds light-house" to "Waackaack or Wilson's beacon," Monmouth County, New Jersey, and the line drawn from "Morgan No. 2" triangulation point, U. S. Coast and Geodetic Survey, in Middlesex County, New Jersey, to "Romer stone beacon."
3. Eight buoys or spindles, to be marked like the permanent monument above mentioned, and placed at suitable intervening points along the line from the said permanent monument to the "Romer stone beacon."
4. The "Romer stone beacon."

In the year 1774 commissions were appointed by New York and Pennsylvania to fix the beginning of the forty-third degree of north latitude



NORTHEAST BOUNDARY OF NEW JERSEY.

on the Mohawk or western branch of Delaware River, which is the northeast corner of Pennsylvania, and to proceed westward and fix the line between Pennsylvania and New York.

These commissioners reported in December of the same year that they fixed the said northeast corner of Pennsylvania, and marked it as follows, viz:

> On a small island in the said river they planted a stone marked with the letters and figures, New York, 1774, cut on the north side thereof; and the letters and figures, latitude 42° variation 4° 20′, cut on the top thereof; and in a direction due west from thence on the west side of the said branch of Delaware, collected and placed a heap of stones at the water mark; and proceeding further west four perches, planted another stone in the said line marked with the letters and figures, Pennsylvania, 1774, cut on the south side thereof, and the letters and figures, latitude 42° variation 4° 20′, cut on the top thereof, and at the distance of eighteen perches due west from the last-mentioned stone marked an ash tree. The rigor of the season prevented them running the line farther.

Nothing further seems to have been done until 1786–'7, when commissioners were appointed to finish the work thus begun (*see* Cary & Biorden's Laws of Pennsylvania, Vol. III, page 392), and the lines were run and monuments erected. The line was ratified in 1789, and is as follows, viz:

> Beginning at a point in Lake Erie, where the boundary line between the United States and Great Britain is intersected by a meridian line drawn through the most westerly bent or inclination of Lake Ontario; then south along said meridian line to a monument in the beginning of the forty-third degree of north latitude, erected in the year one thousand seven hundred and eighty-seven, by Abraham Herdenbergh and William W. Morris, commissioners on the part of this State, and Andrew Ellicott and Andrew Porter, commissioners on the part of the State of Pennsylvania, for the purpose of marking the termination of the line of jurisdiction between this State and the said State of Pennsylvania; then east along the line established and marked by said last-mentioned commissioners to the ninetieth mile-stone in the same parallel of latitude, erected in the year one thousand seven hundred and eighty-six, by James Clinton and Simeon DeWitt, commissioners on the part of this State, and Andrew Ellicott, commissioner on the part of Pennsylvania; which said ninetieth mile-stone stands on the western side of the south branch of the Tioga River; then east along the line established and marked by said last-mentioned commissioners, to a stone erected in the year one thousand seven hundred and seventy-four, on a small island in the Delaware River, by Samuel Holland and David Rittenhouse, commissioners on the part of the colonies of Pennsylvania and New York, for the purpose of marking the beginning of the forty-third degree of north latitude; then down along said Delaware River to a point opposite to the fork or branch formed by the junction of the stream called Mahackamack with the said Delaware River, in the latitude of forty-one degrees, twenty-one minutes and thirty-seven seconds north; then in a straight line to the termination on the east bank of the Delaware River of a line run in the year one thousand seven hundred and seventy-four, by William Wickham and Samuel Gale, commissioners on the part of the then colony of New York, and John Stevens and Walter Rutherford, commissioners on the part of the then colony of New Jersey. (*See* Revised Statutes of New York, 1881.)

The meridian line forming the western boundary of New York was surveyed and mapped in 1790 by Andrew Ellicott, as United States commissioner (Pa. Archives, Vol. XII—Map), and the latitude formerly inscribed on the monument on Lake Erie, fixing the western boundary, was 42° 16′ 13″. The report of the commissioner has not been found.

In 1865 Dr. Peters, director of Hamilton College Observatory, under the directions of the Regents of the University of New York, determined the latitude and longitude of the boundary monument aforesaid, with the following result: Latitude, 42° 16′ 2″.8; longitude, 79° 45′ 54″.4. (*Vide* Dr. Peters' Report, 1868.)

In 1877 the parallel of the forty-second degree north latitude was ascertained at four points, by the New York and Pennsylvania Joint Boundary Commission, with the following result, viz:

1. At Travis Station (Hale's Eddy), very near the east end of that part of the New York and Pennsylvania line supposed to be on the forty second parallel, the old line was found to be 275 feet north of the parallel.
2. At Finn's Station, about 20 miles from east end (Great Bend), the line is 350 feet south of the parallel.
3. At Burt's Station, about 70 miles from east end (Wellsburg), the line is 760 feet north of the parallel.
4. At Clark's Station, about 253 miles from east end (Wattsburg), the line is 150 feet north of the parallel.

(See pamphlet, Report of Penn. Board of the Penn. & N. Y. Joint Boundary Comm.)

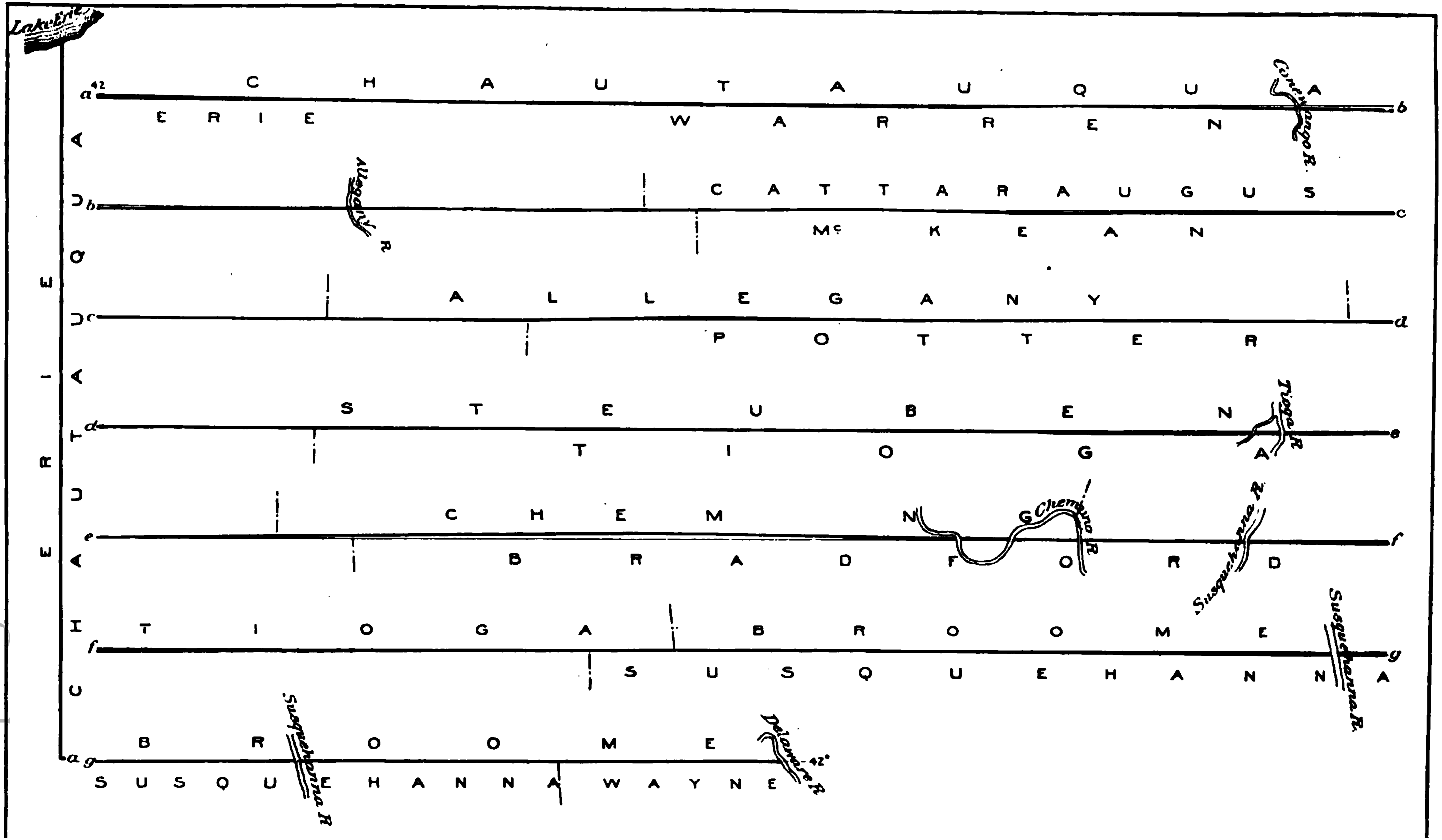
NEW JERSEY.

Although the original grants from the French and English sovereigns of 1603 and 1606 covered the territory forming the present State of New Jersey, the grant which first directly relates to New Jersey is that given in 1664 by the Duke of York to Lord John Berkeley and Sir George Carteret, two months before the setting out of his expedition to take possession of New York.

The following extract from that grant defines the boundaries, viz:

> All that tract of land adjacent to New England, and lying and being to the westward of Long Island and Manhitas Island, and bounded on the east part by the main sea and part by Hudson's River, and hath upon the west Delaware Bay or river, and extendeth southward to the main ocean as far as Cape May, at the mouth of Delaware Bay, and to the northward as far as the northernmost branch of the said bay or river of Delaware, which is forty-one degrees and forty minutes of latitude, and crosseth over thence in a strait line to Hudson's River in forty-one degrees of latitude; which said tract of land is hereafter to be called by the name or names of New Ceaserea or New Jersey. (*Vide* Grants, Concessions, etc., of New Jersey, Leaming & Spicer, p. 8.)

In March, 1673, Lord Berkeley sold his undivided moiety of New Jersey to John Fenwick, by whom, in the following year, it was again sold. July 1, 1676, was executed the famous "Quintipartite deed," by which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TIOGA
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CHEMUNG
BRADFORD
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Susquehanna R
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the eastern part was given to Sir George Carteret, to be called East New Jersey, and the western part to the other proprietors, to be called West New Jersey. Sir George Carteret, at his death in 1678, left his land to be sold. It was sold in 1682 to the twelve proprietors, who admitted other partners.

Confirmation grants were made to the proprietors of both provinces by the Duke of York, and confirmed by the King, but between 1697 and 1701 the proprietors repeatedly made petitions to be allowed to surrender their right of government to the Crown. Accordingly, in 1702, the surrender was made and accepted by the Queen, and both parts united were made the province of New Jersey. (*Vide* Leaming and Spicer's grants, etc.)

(For the history of the northern and eastern boundary, *vide* New York, p. 78.)

The grant from the Duke of York to Berkeley and Carteret defined the west boundary of New Jersey to be the Delaware River. (*Vide* p. 82.)

The line between New Jersey and Delaware is thus described in the Revised Statutes of Delaware, p. 2, viz:

> Low-water mark on the eastern side of the river Delaware, within the twelve-mile circle from New Castle and the middle of the bay, below said circle.

In 1876 the legislature of New Jersey authorized the governor to commence a suit in the Supreme Court of the United States to settle the boundary between New Jersey and Delaware. New Jersey claimed jurisdiction to the middle of the Delaware, so far as the river and bay is a boundary between the two States. (*Vide* Revision of New Jersey, p. 1185.)

In 1783 Commissioners were appointed by New Jersey and Pennsylvania to settle the jurisdiction of the river Delaware and the islands within the same. Their report was ratified, and is in substance as follows:

First. It is declared that the river Delaware from the station point or northwest corner of New Jersey, northerly to the place upon the said river where the circular boundary of the State of Delaware touches upon the same, in the whole length and breadth thereof, is and shall continue to be and remain a common highway, equally free and open for the use, benefit, and advantage of the said contracting parties, etc.

Second. That each State shall enjoy and exercise a concurrent jurisdiction within and upon the water, and not upon the dry land between the shores of said river, etc.

Third. That all islets, islands, and dry land within the bed and between the shores of said river, and between said station point northerly and the falls of Trenton southerly, shall, as to jurisdiction, be hereafter deemed and considered as parts and parcels of the State to which such insulated dry land doth lie nearest at the time of making this agreement, and that from said falls of Trenton to the State of Delaware southerly, certain islands (in the agreement they are named B) be annexed to each State respectively. (*Vide* Revision of New Jersey, p. 1181.)

In 1786 commissioners were appointed by New Jersey and Pennsylvania for more accurately determining and describing the islands mentioned in the foregoing agreement; that is, those in the Delaware from the northwest corner of New Jersey down to the falls of Trenton. Their report was ratified, and a long list of islands, described by name in the act, were annexed to each State respectively. (*Vide* Revision of New Jersey, pp. 1182–'3.)

PENNSYLVANIA.

The Swedish West India Company, chartered by the King of Sweden in 1625, established the first permanent settlement on the west bank of the Delaware, occupying a part of the territory now in Pennsylvania and Delaware, although the Dutch had previously established trading posts, which had been destroyed by the Indians. The Swedes acquired, by successive purchases from the Indian chiefs, all the land extending from Cape Henlopen to the great falls of the Delaware, calling it New Sweden. (*Vide* C. and C., p. 1509.)

In 1655 this territory was surrendered to the Dutch. (*Vide* Hazard's Annals of Pennsylvania, p. 185.)

By the conquest of the New Netherlands, in 1664, the Duke of York seems to have successfully claimed the settlements on the west bank of the Delaware as a part of his dominions.

In 1681 Charles II of England granted to William Penn the Province of Pennsylvania. The following extract from the charter defines the boundaries:

> * * * all that Tracte or Parte of Land in America, with all the Islands therein conteyned, as the same is bounded on the East by Delaware River, from twelve miles distance Northwards of New Castle Towne unto the three and fortieth degree of Northerne Latitude, if the said River doeth extende so farre northwards; But if the said River shall not extend soe farre Northward, then by the said River soe farr as it doth extend; and from the head of the said River the Eastern Bounds are to bee determined by a Meridian Line, to bee drawne from the head of the said River, unto the said three and fortieth degree. The said Lands to extend westwards five degrees in longitude, to bee computed from the said Easterne Bounds; and the said Lands to bee bounded on the North by the beginning of the three and fortieth degree of Northern Latitude, and on the South by a Circle drawne at twelve miles distance from New Castle Northward and Westward unto the beginning of the fortieth degree of Northern Latitude, and thence by a streight Line Westward to the Limit of Longitude above mentioned.

William Penn, in order to perfect his title, procured of the Duke of York a deed bearing date August 21, 1682, by which the Duke of York conveyed to him all title and claim which he might have to the province of Pennsylvania. (*Vide* Hazard's Annals of Pa., 586 *et seq.*)

He also purchased of the Duke of York the territory now comprising the State of Delaware, which he held until 1701–'2, when he granted a charter which enabled them to set up a separate government, though still under proprietary control. (*Vide* O. and O., p. 270 *et seq.*)

(For a history of the northern and eastern boundaries of Pennsylvania, see New York and New Jersey, pp. 80 and 83.]

That part of the southern boundary of Pennsylvania between Pennsylvania and Delaware is an arc of a circle, having for its center the steeple of the old court-house at New Castle, Del., and a radius of 12 miles. This was surveyed and marked under a warrant from William Penn in 1701. (*Vide* Hazard's Annals of Pennsylvania.)

This circular line, in connection with adjacent lines, was made the subject of controversy for many years.

According to the original grants of Pennsylvania and Maryland the boundary between them was to be the fortieth degree of north latitude.

This line being found to pass north of Philadelphia and to exclude Pennsylvania from Delaware Bay, negotiations ensued between the proprietors to rectify this geographical blunder, and for nearly a century the matter remained unsettled.

In the year 1732 an agreement was made to fix the boundary. Commissioners were appointed in that year, and subsequently in 1739, to run the line, but they failed to agree, and chancery suits were the result. Taking a decision of Lord Chancellor Hardwick in 1750 as a basis of final adjudication, an agreement was signed July 4, 1760. By this agreement the line between Pennsylvania and Delaware on the one part and Maryland on the other was determined as follows, viz:

A due east and west line should be run across the peninsula from Cape Henlopen to the Chesapeake Bay. From the exact middle of this line should be drawn a line tangent to the western periphery of a circle, having a radius of 12 English statute miles, measured horizontally from the center of the town of New Castle. From the tangent point a line should be drawn due north until it cut a parallel of latitude 15 miles due south of the most southern part of the city of Philadelphia, this point of intersection to be the northeast corner of Maryland; thence the line should run due west on said parallel as far as it formed a boundary between the two governments. (*Vide* Delaware, p. 87.)

In 1760 commissioners and surveyors were appointed, who spent three years in measuring the base line and the tangent line between Maryland and Delaware.

The proprietors then, wearied with the delay, sent over from England two famous mathematicians, Charles Dixon and Jeremiah Mason, who verified the work of their predecessors, and ran the line west between Pennsylvania and Maryland, since known as "Mason and Dixon's line."

Mason and Dixon fixed the latitude of this line at 39° 43′ 18″. A resurvey in 1850 by Colonel Graham determined it to be 39° 43′ 26″.3.

Mason and Dixon begun their work in 1763, and were stopped by Indians in 1767, having run the line about 244 miles west of the Delaware, not quite finishing their work. They put up mile stones all along said line, every fifth one being marked with the arms of the respective proprietors.

In consequence of the accidental removal of the stone at the northeast corner of Maryland, commissioners were appointed in 1850 by Pennsylvania, Delaware, and Maryland to revise the former survey, which was done by Lieutenant-Colonel Graham, of the United States topographical engineers. The result confirmed the work of Mason and Dixon, and Maryland gained by the resurvey a little less than two acres.

(For a full report of the running of Mason and Dixon's line in 1763–'67, and the verification by Colonel Graham in 1850, see Senate Journal of Delaware for 1851, pages 56–109.)

In 1784 the report of the commissioners who had been appointed to fix the boundaries between Virginia and Pennsylvania (West Virginia then forming part of Virginia) was confirmed, and the lines so fixed are as follows, viz:

> The line commonly called Mason and Dixon's line to be extended due west five degrees of longitude from the river Delaware, for the southern boundary of Pennsylvania, and a meridian drawn from the western extremity thereof to the northern limits of the said States, respectively, be the western boundary of Pennsylvania. (*Vide* C. and B. laws of Pennsylvania, Vol. II, p. 495, and Hening's Virginia, Vol. XI, p. 554.)

By the cession of 1784, by Virginia to the United States—and that of 1800, by Connecticut to the United States, and the formation of the State of West Virginia from a portion of Virginia in 1862—the above-mentioned meridian line becomes the boundary between Pennsylvania on the east, and Ohio and West Virginia on the west.

By an examination of the cession of 1781, by New York to the United States, it will be seen that a small triangular tract on Lake Erie was left in the hands of the General Government. This was sold to Pennsylvania in 1792.

DELAWARE.

The State of Delaware was originally settled by the Swedes. (*Vide* Pennsylvania, p. 84.) In 1655 it was surrendered to the Dutch, who, in 1664, in turn surrendered it to the English, and it was taken possession of by the Duke of York.

William Penn, having received in 1682 a grant of the province of Pennsylvania, bought of the Duke of York the territory comprising the present State of Delaware It was conveyed to him by two deeds of feoffment, dated August 24, 1682, one conveying the town of New Castle and a twelve-mile circle around the same, and the other conveying all the lands south of said circle to Cape Henlopen. (See Hazard's Annals of Pennsylvania, p. 588, *et seq.*)

Soon after the grant made by the royal charter aforesaid, an assembly of the province and three lower counties (then called the territories) was called by the proprietary and governor aforesaid, which met at Chester on the seventh day of December, 1682, when the following laws, among others, were passed, to wit:

> * * * Since * * * it has pleased King Charles the Second * * * to grant * * * William Penn, esq., * * * this Province of Pennsylvania * * * And * James Duke of York and Albany * * * to release his right and claim * * * to the Province of Pennsylvania * * * and * * * to grant unto the said William Penn * * * all that tract of land from twelve miles northward of New Castle, on the river Delaware, down to the South Cape (commonly called Cape Henlopen, and by the Proprietary and Governor now called Cape Jomus) lying on the west side of the said river and bay, * * * lately cast into three counties, called New Castle, Jones, and Whorekills (alias New Dale. * * * Be it enacted * * that the counties of New Castle, Jones, and Whorekills alias New Dale * * * are annexed to the Province of Pennsylvania. * * * (Dallas' Laws of Pennsylvania, 1797, Vol. I, Appendix, p. 24, *et seq*).

In 1701 William Penn granted a charter, under which the province of Pennsylvania and the territories (as Delaware was then called) were made separate governments, though both were still under the proprietary government of William Penn. (C. & C., p. 270.)

By the Revolution the "territories" became the State of Delaware, with substantially her present boundaries.

(For a history of the boundaries between Delaware and Pennsylvania, *vide* Pennsylvania, p. 85, and between Delaware and New Jersey, *vide* New Jersey, p. 83, *et seq.*)

From 1732 to 1769 there was a controversy between the proprietors of Pennsylvania and Maryland in regard to boundaries (*vide* p. 85). The boundaries of Delaware on the north and west—Delaware then being under the jurisdiction of Pennsylvania—were determined as follows, viz:

Beginning at Cape Henlopen and running due west 34 miles 309 perches; thence in a straight line 81 miles 78 chains and 30 links up the peninsula until it touches and makes a tangent to the western periphery of a circle, drawn at the horizontal distance of twelve English statute miles from the center of the town of New Castle.

From this tangent point a line was run due north till it cut a parallel of latitude 15 miles due south of the most southern part of the city of Philadelphia. This point of intersection is the northeast corner of Maryland. The tangent line bearing a little west of north, the due north line from the tangent point cuts off an arc of the 12-mile circle. The boundary line follows the arc of the circle from the tangent point around to the point where the due north line intersects the 12-mile circle, then follows said due north line to said northeast corner of Maryland. The length of said due north line is 5 miles 1 chain and 50 links, as given by Mason and Dixon. (*Vide* Jour. Del. Sen., 1851, p. 56 *et seq.*)

By the agreement of 1760, based on the decree of Chancellor Hardwick, a due east and west line should be run across the peninsula from Cape Henlopen to Chesapeake Bay, etc. The decree of Lord Hardwick says, touching the position of Cape Henlopen, "that Cape Henlopen ought to be deemed and taken to be situated at the place where the same is laid down and described in the map or plan annexed to the said articles to be situated, and therefore his lordship doth further order and decree that the said articles be carried into execution accordingly," etc.

In Hazard's Annals of Pennsylvania, p. 5, is found the following, viz: "The cape now called Henlopen was then called Cornelis."

William Penn directed that Cape Henlopen be called Cape James. (*Vide* Hazard's Pennnsylvania, p. 606; also *vide* Act of union of the territories to Pennsylvania.)

The foregoing statements explain the seeming incongruity between the base line across the peninsula and the position of Cape Henlopen as laid down on all modern maps.

MARYLAND.

The territory comprising the present area of Maryland was included in the previous charters of Virginia, notwithstanding which, in the year 1632, Lord Baltimore received a royal grant of the province of Maryland, whose boundaries are defined in the following extract:

> All that part of the Peninsula or Chersonese, lying in parts of America, between the ocean on the east and the Bay of Chesapeake on the west; divided from the residue thereof by a right line drawn from the promontory or headland called Watkins Point, situate upon the bay aforesaid, near the River Wighco on the west unto the main ocean on the east, and between that boundary on the south unto that part of the Bay of Delaware on the north, which lieth under the fortieth degree of north latitude from the equinoctial, where New England is terminated; and all the tract of that land within the metes underwritten (that is to say), passing from the said bay, called Delaware Bay, in a right line, by the degree aforesaid, unto the true meridian of the first fountain of the River Pattowmack; thence verging towards the south unto the farther bank of the said river, and following the same on the west and south unto a certain place called Cinquack, situate near the mouth of said river, where it disembogues into the aforesaid Bay of Chesapeake, and thence by the shortest line unto the aforesaid promontory or place called Watkins Point, so that the whole tract of land divided by the line aforesaid, between the main ocean and Watkins Point unto the promontory called Cape Charles, may entirely remain forever excepted to us * * * * * *.

By an examination of the limits laid down in this charter, and a comparison with the several charters of Virginia and the charter and deeds to William Penn, it will be seen that there was a conflict of boundaries on both sides of the Maryland grant.

The history of the long controversy with Pennsylvania has already been given (*vide* Pennsylvania, p. 85, and Delaware, p. 87). Virginia on the south claimed the territory under her charters, and for a time seemed disposed to assert her claim, notwithstanding we find in 1638 a proclamation by the governor and council of Virginia recognizing the province of Maryland, and forbidding trade with the Indians within the limits of Maryland without the consent of Lord Baltimore previously obtained (*vide* Bozman's Maryland, vol. II, p. 586). Virginia's claim was finally given up by a treaty or agreement made in 1658. (For a full account *vide* Bozman's Maryland, p. 444 *et seq.*)

In 1663 the Virginia assembly ordered a survey of the line between Virginia and Maryland on the peninsula, and declared it to be as follows, viz:

> From Watkins Point east across the peninsula.

They define Watkins Point

> To be the north side of Wicomicoe River on the Eastern shore and neere unto and on the south side of the streight limbe opposite to Patuxent River.

(*Vide* Hening's Virginia, vol. II, p. 184.)

In 1668 commissioners were appointed by Maryland and Virginia to fix the boundary across the peninsula. The commissioners were Philip Calvert, esq., chancellor of Maryland, and Col. Edmund Scarbrugh, his majesty's surveyor-general of Virginia. Their report is as follows, viz:

> * * * After a full and perfect view taken of the point of land made by the north side of Pocomoke Bay and south side of Annamessexs Bay have and do conclude the same to be Watkins Point, from which said point so called, we have run an east line, agreeable with the extreamest part of the westermost angle of the said Watkins Point, over Pocomoke River to the land near Robert Holston's, and there have marked certain trees which are so continued by an east line running over Swansecutes Creeke into the marsh of the seaside with apparent marks and boundaries * * * Signed June 25, 1668. (*Vide* Md. Hist. Soc. Coll. of State papers, volume marked 4 L. C. B., pp. 63-64.)

Virginia, by the adoption of her constitution of 1776 (see Article 21), relinquished all claim to territory covered by the charter of Maryland, thereby fixing Maryland's western boundary as follows:

> Commencing on a true meridian of the first fountain of the river Pattawmack, thence verging towards the south unto the further bank of the said river and following the same on the west and south unto a certain place called Cinquack, situate near the mouth of said river where it disembogues into the aforesaid bay of Chessopeake, and thence by the shortest line unto the aforesaid promontory or place called Watkins Point, thence a right line to the main ocean on the east. (See charter of Maryland.)

The foregoing are substantially the present boundaries; but from that time up to the present a controversy has been going on concerning them.

In 1786 a compact was entered into between the States of Maryland and Virginia, but as this referred more particularly to the navigation and exercise of jurisdiction on the waters of Chesapeake Bay, the Potomac and Pocomoke Rivers, they are not given here. (*Vide* Hening's Va., Vol. XII, p. 50.)

From 1821 to 1858 frequent legislation took place in regard to this boundary.

In the last-named year commissioners were appointed by Maryland and Virginia, respectively, who, with the assistance of Lieut. N. Michler, United States Engineers, surveyed the lines.

In 1860 the governor of Virginia, under a resolution of the legislature, appointed and sent an agent to England to collect records and documentary evidence bearing on this question.

The rebellion ensuing, nothing further was done until 1867, when legislation again commenced.

The question of this boundary was referred to arbitrators by an agreement made in 1874, each State binding itself to accept their award as final and conclusive.

J. S. Black, of Pennsylvania; William A. Graham, of North Carolina, and Charles A. Jenkins, of Georgia, were appointed arbitrators.

William A. Graham having died, James B. Beck, of Kentucky, was appointed in his stead.

The arbitrators made, in 1877, the following award, viz:

Beginning at the point on the Potomac River where the line between Virginia and West Virginia strikes the said river at low-water mark, and thence following the meanderings of said river by the low-water mark to Smith's Point, at or near the mouth of the Potomac, in the latitude 37° 53′ 8″ and longitude 76° 13′ 46″; thence crossing the waters of the Chesapeake Bay, by a line running north 65° 30′ east, about nine and a half nautical miles to a point on the western shore of Smith's Island at the north end of Sassafras Hammock, in latitude 37° 57′ 13″, longitude 76° 2′ 52″; thence across Smith's Island south 88° 30′ east five thousand six hundred and twenty yards to the center of Horse Hammock, on the eastern shore of Smith's Island, in latitude 37° 57′ 8″, longitude 75° 59′ 20″; thence south 79° 30′ east four thousand eight hundred and eighty yards to a point marked "A" on the accompanying map, in the middle of Tangier Sound, in latitude 37° 56′ 42″, longitude 75° 56′ 23″, said point bearing from James Island light south 54° west, and distant from that light three thousand five hundred and sixty yards; thence south 10° 30′ west four thousand seven hundred and forty yards by a line dividing the waters of Tangier Sound, to a point where it intersects the straight line from Smith's Point to Watkins Point, said point of intersection being in latitude 37° 54′ 21″, longitude 75° 56′ 55″, bearing from James Island light south 29° west and from Horse Hammock south 34° 30′ east. This point of intersection is marked "B" on the accompanying map. Thence north 85° 15′ east six thousand seven hundred and twenty yards along the line above mentioned, which runs from Smith's Point to Watkins Point until it reaches the latter spot, namely Watkins Point, which is in latitude 37° 54′ 38″, longitude 75° 52′ 44″. From Watkins Point the boundary line runs due east seven thousand eight hundred and eighty yards to a point where it meets a line running through the middle of Pocomoke Sound, which is marked "C" on the accompanying map, and is in latitude 37° 54′ 38″, longitude 75° 47′ 50″; thence by a line dividing the waters of Pocomoke Sound north 47° 30′ east five thousand two hundred and twenty yards to a point in said sound marked "D" on the accompanying map, in latitude 37° 56′ 25″, longitude 75° 45′ 26″; thence following the middle of Pocomoke River by a line of irregular curves, as laid down on the accompanying map, until it intersects the westward protraction of the boundary line marked by Scarborough and Calvert, May 28, 1668, at a point in the middle of Pocomoke River, and in the latitude 37° 59′ 37″, longitude 75° 37′ 4″; thence by the Scarborough and Calvert line, which runs 5° 15′ north of east, to the Atlantic Ocean.

The latitudes, longitudes, courses, and distances here given have been measured upon the Coast Chart No. 33 of U. S. Coast Survey, sheet No. 3, Chesapeake Bay. * * * The middle thread of the Pocomoke River and the low-water mark on the Potomac River are to be measured from headland to headland, without considering or following arms, inlets, creeks, bays, or affluent rivers. * * * (*Vide* U. S. Stat. at Large, Vol. XX, p. 481.)

This award was ratified by the States of Maryland and Virginia, and confirmed by Congress in 1879.

In 1879–'80 acts were passed by the legislatures of Maryland and Virginia to appoint commissioners and to request the General Government to designate one or more officers of the Engineer Corps, said commissioners and officers to survey and mark said line and erect monuments thereon.

West Virginia having been formed from a part of Virginia and admitted into the Union in 1862, the western boundary of Maryland now separates it from the State of West Virginia.

The commissioners appointed in 1859 by Virginia and Maryland (*vide* p. 90) surveyed the western boundary from the "Fairfax Stone" (the first fountain of the Potomac) due north to the Pennsylvania line, and the legislature of Maryland in 1860 passed an act declaring that line to to be its western boundary.

From the "Fairfax Stone" the boundary between Maryland and West Virginia runs along the south bank of the Potomac River till it strikes the line between Virginia and West Virginia.

(For a history of the placing of the Fairfax Stone, *vide* Virginia, p. 96.)

DISTRICT OF COLUMBIA.

On the 5th day of September, 1774, the Continental Congress met at Philadelphia. Two years later they adjourned to Baltimore. During the Revolution and subsequent to the treaty of peace they met in various places. After the close of the war much debate took place in regard to the location of a permanent seat of the Government of the United States. Several States made propositions to Congress, offering to cede certain lands for the purpose, but no determination of the location was made by Congress until 1790.

Act of cession from the State of Maryland, passed December 23, 1788.

On the 23d of December, 1788, the State of Maryland passed the following act, viz:

Be it enacted by the general assembly of Maryland, That the representatives of this

State in the House of Representatives of the Congress of the United States, appointed to assemble at New York, on the first Wednesday of March next, be and they are hereby authorised and required on the behalf of this State to cede to the Congress of the United States, any district in this State not exceeding ten miles square, which the Congress may fix upon and accept for the seat of government of the United States.

In the following year (December 3, 1789), the State of Virginia passed a similar act, of which the following is an extract:

Be it therefore enacted by the general assembly, That a tract of country not exceeding ten miles square or any lesser quantity, to be located within the limits of the State, and in any part thereof as Congress may by law direct shall be, and the same is hereby, forever ceded and relinquished to the Congress and Government of the United States, in full and absolute right and exclusive jurisdiction, as well of said soil as of persons residing or to reside thereon, pursuant to the tenor and effect of the eighth section of the 1st article of the Constitution of the Government of the United States.

After long discussion, Congress in 1790, in view of the foregoing cessions of Maryland and Virginia, passed the following act, viz:

AN ACT for establishing the temporary and permanent seat of government of the United States. Approved July 16, 1790.

SECT. 1. *Be it enacted by the Senate and House of Representatives of the United States of America in Congress assembled,* That a district of territory, not exceeding ten miles square, to be located as hereafter directed on the river Potowmac, at some place between the mouth of the Eastern Branch and Connoyocheque, be, and the same is hereby, accepted for the permanent seat of the government of the United States. *Provided nevertheless,* That the operation of the laws of the State within such district shall not be affected by this acceptance until the time fixed for the removal of the government thereto, and until Congress shall otherwise by law provide.

SECT. 2. *And be it further enacted,* That the President of the United States be authorized to appoint, and by supplying vacancies happening from refusals to act or other causes, to keep in appointment as long as may be necessary, three commissioners, who, or any two of whom, shall, under the direction of the President, survey, and by proper metes and bounds define and limit, a district of territory, under the limitations above mentioned; and the district so defined, limited, and located shall be deemed the district accepted by this act for the permanent seat of the government of the United States.

SECT. 3. *And be it enacted,* That the said commissioners, or any two of them, shall have power to purchase or accept such quantity of land on the eastern side of the said river within the said district as the President shall deem proper for the use of the United States, and according to such plans as the President shall approve. The said commissioners, or any two of them, shall, prior to the first Monday in December in the year 1800, provide suitable buildings for the accommodation of Congress, and of the President, and for the public offices of the government of the United States.

SECT. 4. *And be it enacted,* That for defraying the expenses of such purchases and buildings the President of the United States be authorized and requested to accept grants of money.

SECT. 5. *And be it enacted,* That prior to the first Monday in December next all offices attached to the seat of government of the United States shall be removed to, and until the first Monday in December in the year 1800 shall remain at, the city of Philadelphia, in the State of Pennsylvania, at which place the session of Congress next ensuing the present shall be held.

SECT. 6. *And be it enacted,* That on the first Monday in December, in the year 1800, the seat of the government of the United States, shall, by virtue of this act, be transferred to the district and place aforesaid. And all offices attached to the said seat of government shall accordingly be removed thereto by their respective holders, and shall, after the said day, cease to be exercised elsewhere, and that the necessary expense of said removal, shall be defrayed out of the duties on imposts and tonnage, of which a sufficient sum is hereby appropriated.

In the following year the foregoing act was amended, in order to include a portion of the Anacostia River ("Eastern Branch"), and the town of Alexandria within the limits of the district.

The following is the act of amendment:

AN ACT to amend "An act for establishing the temporary and permanent seat of government of the United States." Approved March 3, 1791.

Be it enacted, &c., That so much of the act entitled "An act for establishing the temporary and permanent seat of the government of the United States, as requires that the whole of the district of territory, not exceeding ten miles square, to be located on the river Potowmac, for the permanent seat of the government of the United States, shall be located above the mouth of the Eastern Branch, be and is hereby repealed, and that it shall be lawful, for the President to make any part of the territory below said limit and above the mouth of Hunting Creek, a part of the said district so as to include a convenient port of the Eastern Branch, and of the lands lying on the lower side thereof; and also the town of Alexandria, and the territory so to be included shall form a part of the district not exceeding ten miles square for the permanent seat of the government of the United States, in like manner, and to all intents and purposes, as if the same had been within the the purview of the above recited act: *Provided*, That nothing herein contained, shall authorize the erection of the public buildings, otherwise than on the Maryland side of the river Potowmac, as required by the aforesaid act.

In pursuance of the foregoing acts, three commissioners were appointed, who made preliminary surveys of the territory, and on the 30th day of March, 1791, George Washington, President of the United States, issued a proclamation, in which the bounds of the said District were defined as follows, viz:

Beginning at Jones' Point, being the upper cape of Hunting Creek, in Virginia, and at an angle in the outset of 45° west of the north, and running in a direct line ten miles for the first line; then beginning again at the same Jones' Point and running another direct line at a right angle with the first, across the Potomac, ten miles for the second line; then, from the terminations of the said first and second lines, running two other direct lines, of ten miles each, the one crossing the Potomac and the other the Eastern Branch aforesaid, and meeting each other in a point.

In 1800 Congress removed to this District. In the following year the District was divided into two counties, as follows, viz:

UNITED STATES STATUTES AT LARGE, SIXTH CONGRESS, SECOND SESSION, 1801, (CHAPTER XV).

AN ACT concerning the District of Columbia.

The said District of Columbia shall be formed into two counties. One county shall contain all that part of said District which lies on the east side of the river Potomac, together with the islands therein, and shall be called the county of Washington, the other county shall contain all that part of said District which lies on the west side of said river, and shall be called the county of Alexandria; and the said river, in its whole course through said District, shall be taken and deemed to all intents and purposes to be within both of said counties.

In 1846 Congress passed an act retroceding to the State of Virginia that part of the District of Columbia originally ceded to the United States by Virginia. The following is an extract from said act of retrocession:

> That with assent of the people of the county and town of Alexandria, to be ascertained as hereinafter prescribed, all of that portion of the District of Columbia ceded to the United States by the State of Virginia, and all the rights and jurisdiction therewith ceded over the same, be, and the same are, hereby ceded and forever relinquished to the State of Virginia in full and absolute right and jurisdiction, as well of soil as of persons residing or to reside thereon.

VIRGINIA.

In the year 1606 King James I of England granted the "First Charter of Virginia." The boundaries therein described are as follows, viz:

> * * * Situate, lying, or being all along the sea coasts, between four and thirty degrees of northerly latitude from the equinoctial line, and five and forty degrees of the same latitude, and in the main land between the same four and thirty and five and forty degrees and the islands thereunto adjacent, or within one hundred miles of the coast thereof. * * *

Soon after, in 1609, a new charter was granted, called the "Second Charter of Virginia," which defines the boundaries in the following terms:

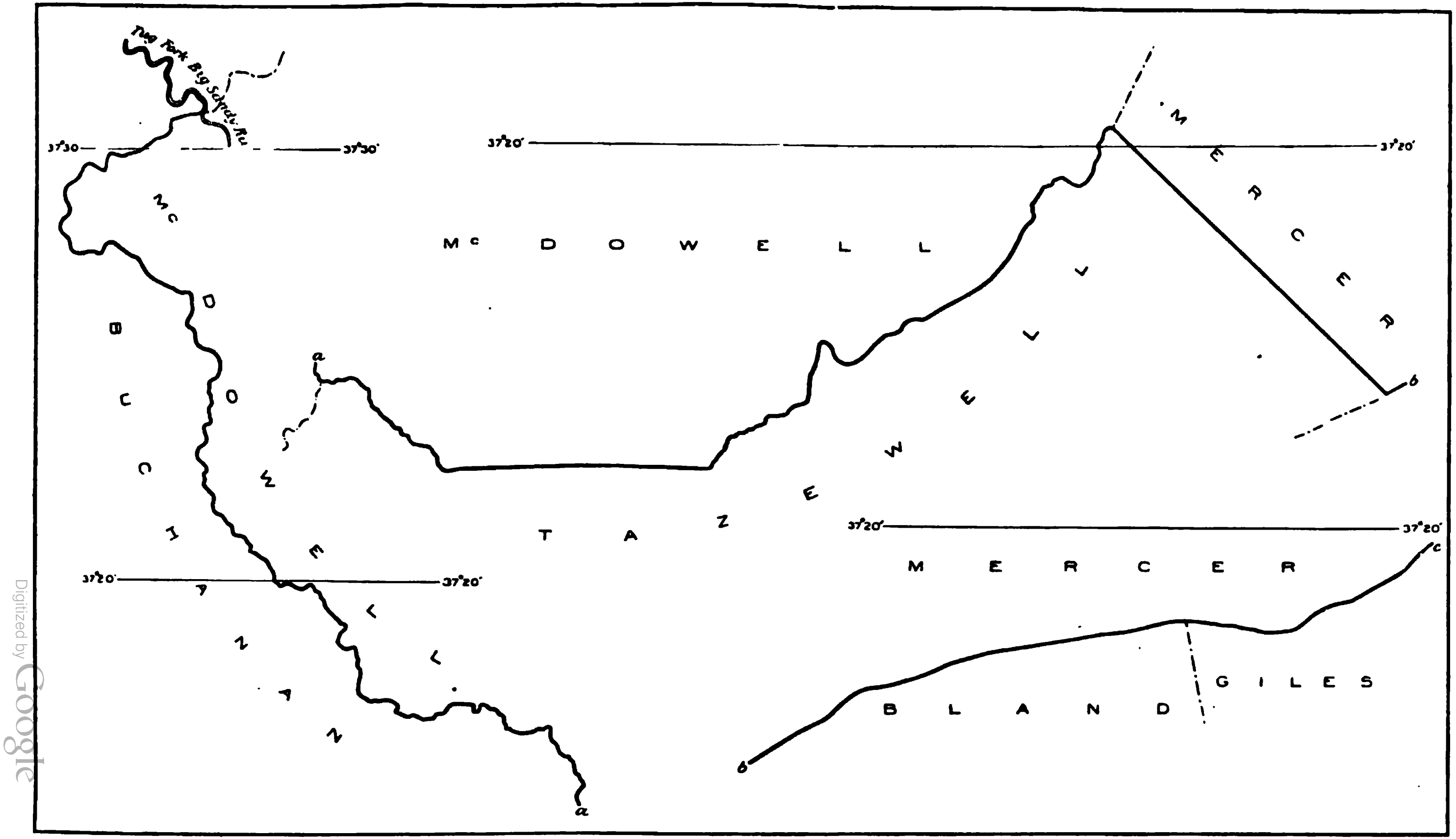
> * * * Situate, lying, and being in that part of America called Virginia, from the point of land called Cape or Point Comfort, all along the sea coast to the northward two hundred miles, and from the said point of Cape Comfort all along the sea coast to the southward two hundred miles, and all that space and circuit of land lying from the sea coast of the precinct aforesaid up into the land, throughout from sea to sea, west and northwest, and also all the islands lying within one hundred miles along the coast of both seas of the precinct aforesaid. * * *

In 1611-'12 the "Third Charter of Virginia" was granted, which was an enlargement of the second, of which the following is an extract:

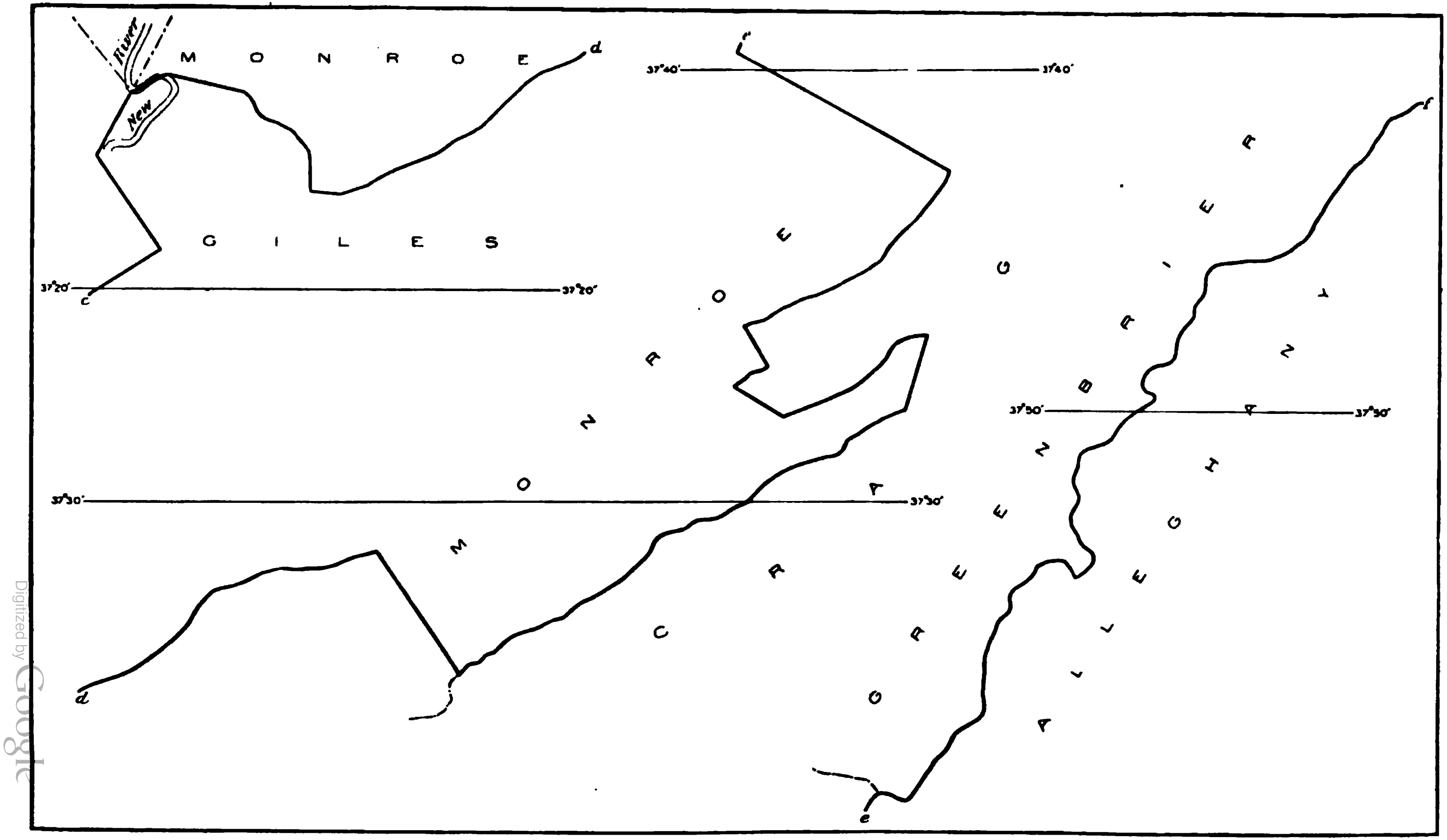
> All and singular those islands whatsoever, situate and being in any part of the ocean seas bordering upon the coast of our said first colony in Virginia, and being within three hundred leagues of any of the portes heretofore granted to the said treasurer and company in our former letters-patents as aforesaid, and being within or between the one-and-fortieth and thirtieth degrees of northerly latitude.

These boundaries, as will be seen, included territory composing wholly, or in part, the present States of Pennsylvania, Delaware, Maryland, North and South Carolina, in addition to others formed since the Revolution.

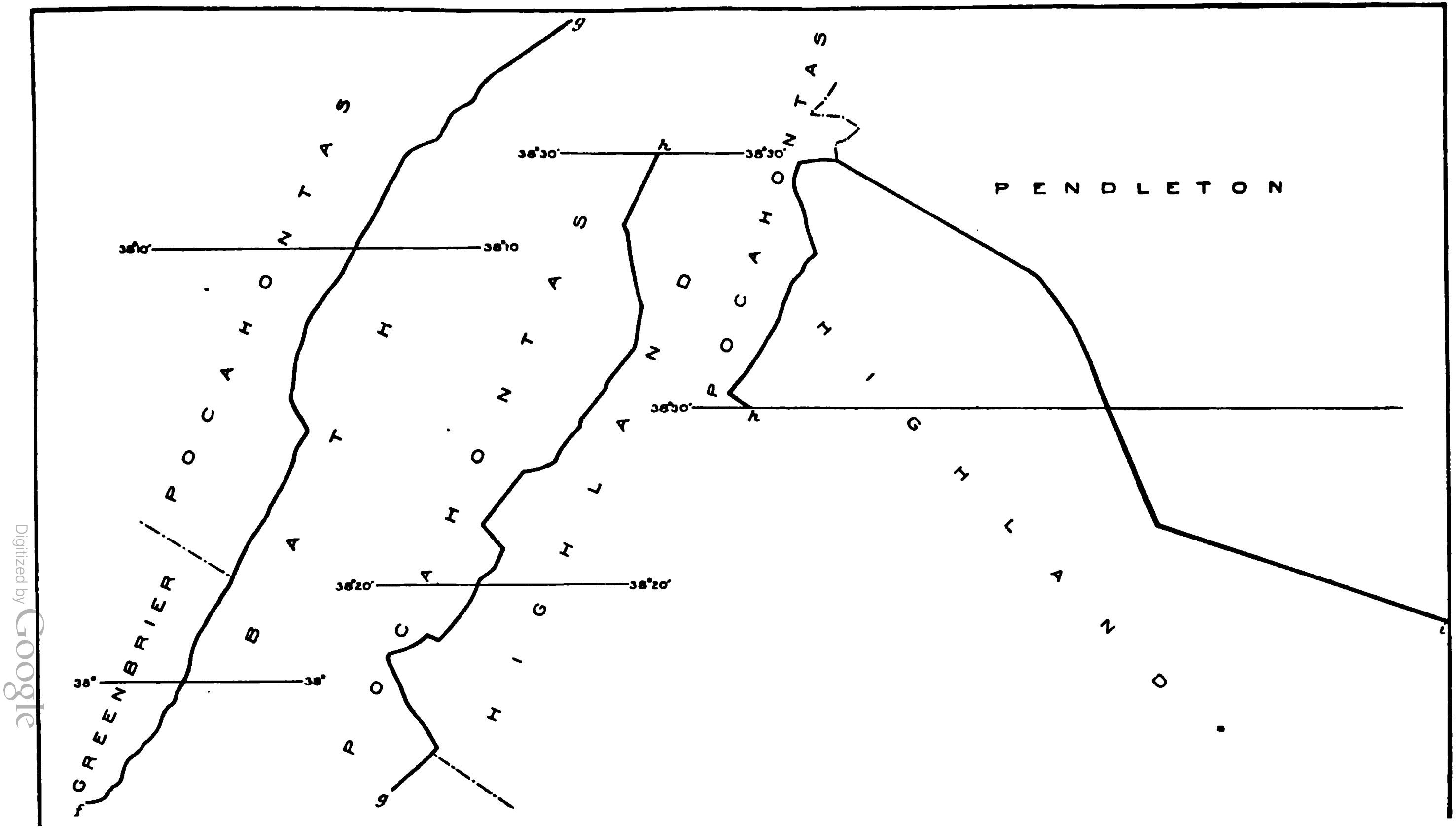
This large extent of territory was reduced in the first instance by the charter of Maryland in 1632, next by the charters of Carolina in 1663 and 1665, then by the charter of Pennsylvania in 1681, and, again, subsequent to the Revolution, by the cession to the United States of the territory northwest of the Ohio River in 1784; by the admission of



BOUNDARY BETWEEN VIRGINIA AND WEST VIRGINIA.



BOUNDARY BETWEEN VIRGINIA AND WEST VIRGINIA.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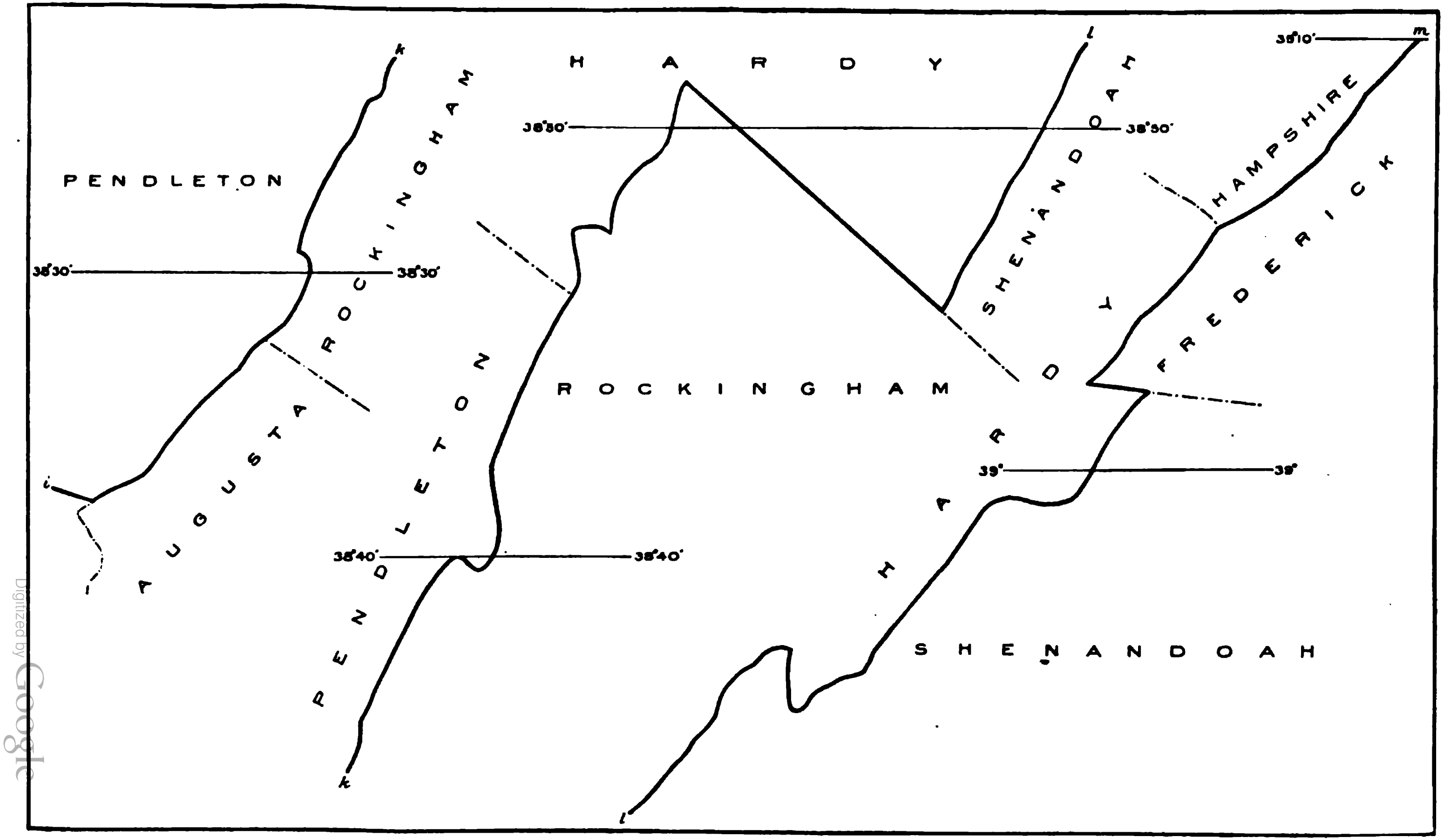

BOUNDARY BETWEEN VIRGINIA AND WEST VIRGINIA.

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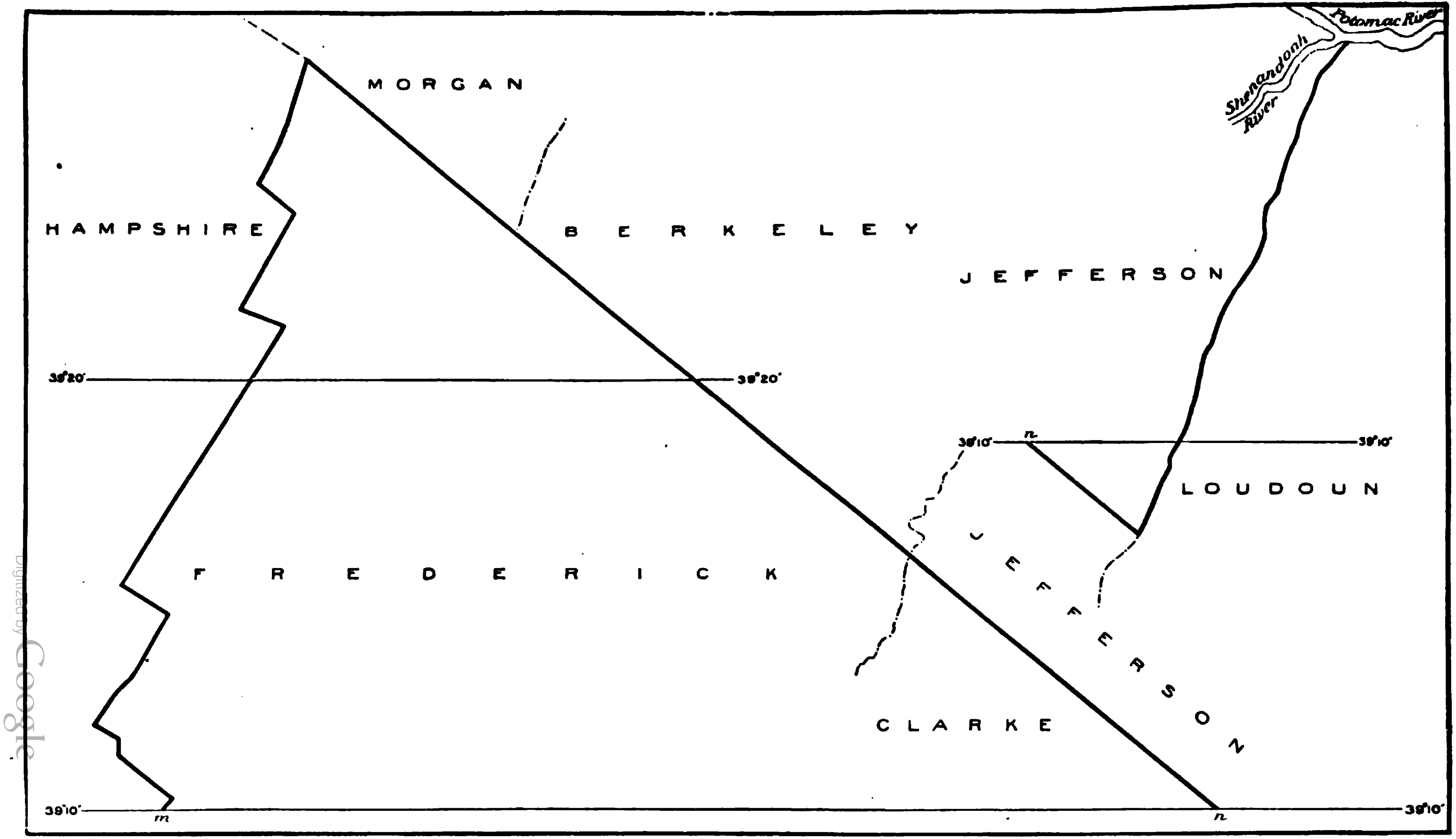


BOUNDARY BETWEEN VIRGINIA AND WEST VIRGINIA.

Kentucky as an independent State in 1792, and lastly by the division of the territory of Virginia in 1862, by which the new State of West Virginia was created and admitted into the Union.

By the constitution of 1776 Virginia formally gave up all claim to the territory now appertaining to the neighboring States of Maryland, Pennsylvania, North and South Carolina.

The following is an extract from the Virginia constitution of 1776:

> The territories contained within the charters erecting the colonies of Maryland, Pennsylvania, North and South Carolina, are hereby ceded, released, and forever confirmed to the people of these colonies, respectively, with all the rights of property, jurisdiction, and government, and all the rights whatsoever, which might at any time heretofore have been claimed by Virginia, except the free navigation and use of the rivers Potomaque and Pokomoke, with the property of the Virginia shores and strands bordering on either of said rivers, and all improvements which have been or shall be made thereon. The western and northern extent of Virginia shall, in all other respects, stand as fixed by the charter of King James I, in the year one thousand six hundred and nine, and by the public treaty of peace between the courts of Britain and France in the year one thousand seven hundred and sixty-three, unless by act of the legislature one or more governments be established westwards of the Alleghany Mountains.

In the mean time a grant of territory had been made, within the present limits of Virginia and West Virginia, which caused great dissatisfaction to the people of the Virginia Colony, and which ultimately had an important bearing in settling the divisional line between Maryland and Virginia.

In the 21st year of Charles II a grant was made to Lord Hapton and others of what is called the northern neck of Virginia, which was sold by the other patentees to Lord Culpeper and confirmed to him by letters-patent in the fourth year of James II. This grant carried with it nothing but the right of soil and incidents of ownership, it being expressly subjected to the jurisdiction of the government of Virginia. The tract of land thereby granted was "bounded by and within the heads of the rivers Tappahannock, alias Rappahannock, and Quiriough, alias Patomac, rivers." On the death of Lord Culpeper, this proprietary tract descended to Lord Fairfax, who had married Lord Culpeper's only daughter.

As early as 1729 difficulties sprung up, arising from conflicting grants from Lord Fairfax and the Crown.

In 1730 Virginia petitioned the King, reciting that the head springs of the Rappahannock and Potomac Rivers were not known, and praying that such measures might be taken that they might be ascertained to the satisfaction of all parties.

In 1733 Lord Fairfax made a similar petition, asking that a commission might issue for running out, marking, and ascertaining the true boundaries of his grant.

An order, accordingly, was issued and three commissioners were appointed on the part of the Crown and three on the part of Lord Fairfax.

The duty which devolved upon these commissioners was to ascertain by actual examination and survey the respective fountains of the Rappahannock and Potomac Rivers. This survey was made in 1736.

The report of the commissioners was referred to the council for plantation affairs in 1738, who reported their decision in 1745, as follows, viz:

> * * * The said boundary ought to begin at the first spring of the south branch of the river Rappahannock, and that the said boundary be from thence drawn in a straight line northwest to the place in the Alleghany Mountains where that part of the Potomac River, which is now called Cohongoroota, first rises. * * *

This report was confirmed by the King, and commissioners were appointed to run and mark the dividing line accordingly.

The line was run in 1746. On the 17th day of October, 1746, they planted the Fairfax stone at the spot which had been described and marked by the preceding commissioners as the true head spring of the Potomac River, and which, notwithstanding much controversy, has continued to be regarded, from that period to the present time, as the southern point of the western boundary between Virginia and Maryland. (*Vide* Faulkner's Report to Governor of Virginia, 1832. For full details, *vide* Byrd Papers, 1866, Vol. II, p. 83 *et seq.* Also Hening's Va. Statutes.)

This tract of country was held by Lord Fairfax and his descendants many years, but subsequent to the Revolution the quitrents, charges, etc., were abolished and it became in all respects subject to the jurisdiction of Virginia.

(For the history of the settlement of the boundary lines between Virginia and Maryland, *vide* Maryland, p. 89.)

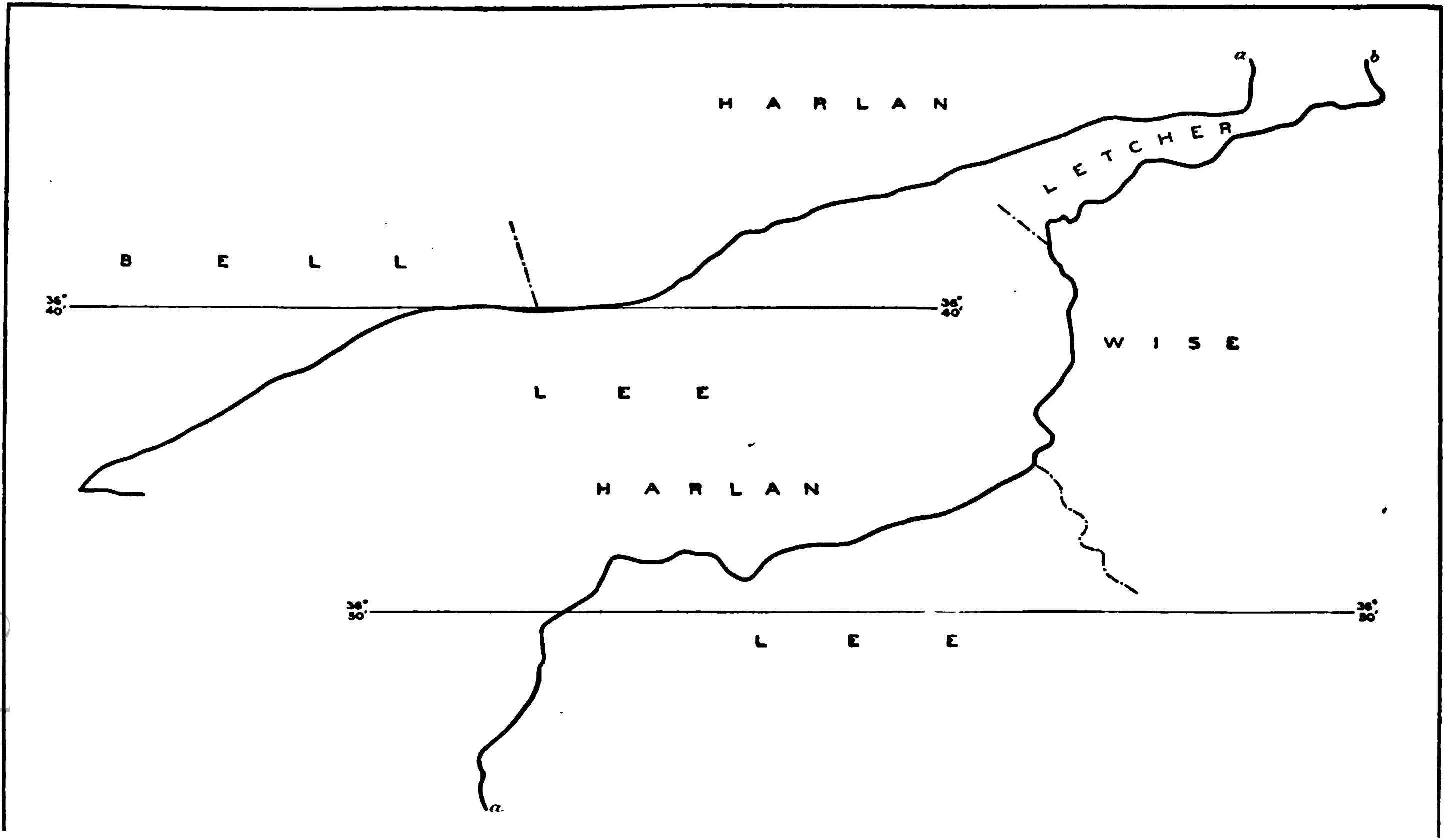
(For a history of the boundary between Virginia and Pennsylvania, *vide* Pennsylvania, p. 87.)

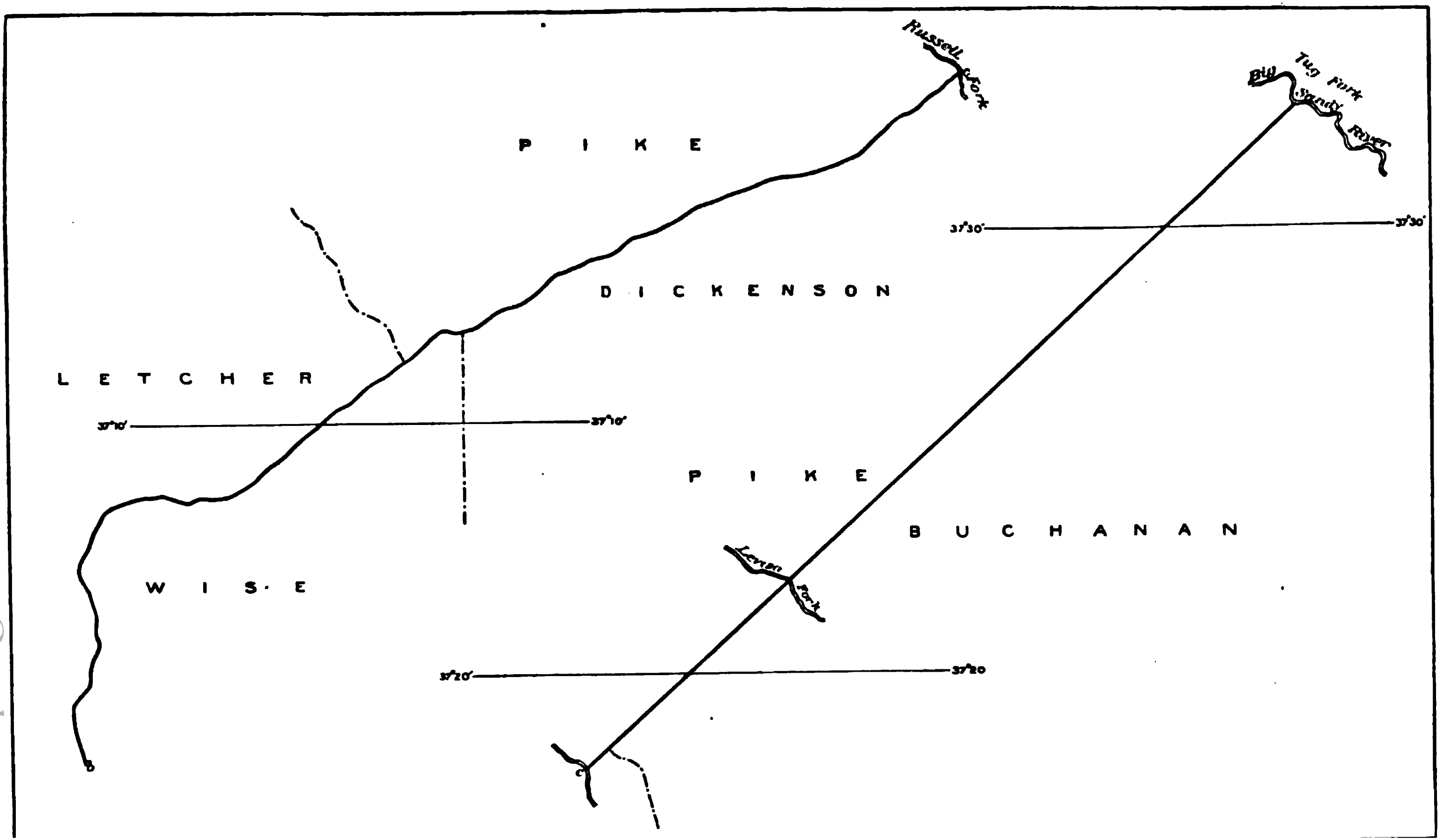
Kentucky formed originally a part of the county of Fincastle, Virginia. In the year 1776, this county was divided into three counties, the westernmost of which was called Kentucky County, and its eastern boundary was declared to be as follows, viz:

> A line beginning on the Ohio, at the mouth of Great Sandy Creek, and running up the same and the main or northeasterly branch thereof to the Great Laurel Ridge or Cumberland Mountains; thence southwesterly along the said mountain to the line of North Carolina. (See Hening's Statutes, Virginia, Vol. 9, p. 257.)

Kentucky having been admitted into the Union June 1, 1792, commissioners were appointed in 1798 by Virginia and Kentucky to fix the boundary. In 1799–1800 the commissioners' report was made and ratified by the States. It was as follows, viz:

> To begin at the point where the Carolina, now Tennessee, line crosses the top of the Cumberland Mountains, near Cumberland Gap, thence northeastwardly along the top or highest part of the said Cumberland Mountain, keeping between the head waters of Cumberland and Kentucky Rivers, on the west side thereof, and the head waters of Powell's and Guest's Rivers, and the Pond Fork of Sandy, on the east side therof, continuing along the said top, or highest part of said mountain, crossing the road


a
b
HARLAN
LETCHER
BELL
36° 40′
36° 40′
WISE
LEE
HARLAN
36° 50′
36° 50′
LEE
a


Russell Fork
Big Sandy River
Tug Fork
PIKE
DICKENSON
LETCHER
37°10'
37°10'
PIKE
BUCHANAN
WISE
Levisa Fork
37°30'
37°30'
37°20'
37°20
B
C

leading over the same at the Little Paint Gap, where by some it is called the Hollow Mountain and where it terminates at the West Fork of Sandy, commonly called Russell's Fork, thence with a line to be run north 45° east till it intersects the other great principal branch of Sandy, commonly called the Northeastwardly branch, thence down the said Northeastwardly branch to its junction with the main west branch and down Main Sandy to its confluence with the Ohio. (See Shepard's Virginia, Vol. 2, p. 234.)

It will be seen that the latter part of this line is the present line between West Virginia and Kentucky.

(For the history of the settlement of the boundaries between Virginia and North Carolina, *vide* North Carolina, *vide* p. 100.)

In 1779 Virginia and North Carolina appointed commissioners to run the boundary line between the two States west of the Allegheny Mountains, on the parallel of 36° 30′. The commissioners were unable to agree on the location of the parallel; they therefore ran two parallel lines two miles apart, the northern known as Henderson's, and claimed by North Carolina, the southern known as Walker's line, and claimed by Virginia. In the year 1789 North Carolina ceded to the United States all territory west of her present boundaries, and Tennessee being formed from said ceded territory, this question became one between Virginia and Tennessee.

Commissioners having been appointed by Virginia and Tennessee to establish the boundary, their report was adopted in 1803, and was as follows, viz:

> A due west line equally distant from both Walker's and Henderson's, beginning on the summit of the mountain generally known as White Top Mountain, where the northeast corner of Tennessee terminates, to the top of the Cumberland Mountain, where the southwestern corner of Virginia terminates.

In 1871 Virginia passed an act to appoint commissioners to adjust this line.

Tennessee, the following year, in a very emphatic manner, passed a resolution refusing to reopen a question regarding a boundary which she considered "fixed and established beyond dispute forever." (See acts of Tennessee, 1872.)

Up to 1783 Virginia exercised jurisdiction over a large tract of country northwest of the Ohio River. But by a deed executed March 1, 1784, she ceded to the United States all territory lying northwest of the Ohio River, thus making her western boundary the west bank of the Ohio River.

On the 31st of December, 1862, the State of Virginia was divided, and 48 counties, composing the western part of the State, were made the new State of West Virginia. By an act of Congress in 1866, consent was given to the transfer of two additional counties from Virginia to West Virginia.

In 1873 and 1877 commissioners were appointed by each State to determine the true boundaries between the two States, and the General

Government was asked to detail officers of engineers to act with said commissioners in surveying and fixing the line.

Until their report is at hand, the boundary can only be found by following the old county lines. In view of the expectation of such report at an early day, it has not been thought best to go into an examination of the old county lines.

WEST VIRGINIA.

This State was set off from Virginia on December 31, 1862. It was originally formed of those counties of Virginia which had refused to join in the secession movement. It was admitted to the Union as a separate State, June 19, 1863. It originally contained the following counties: Barbour, Boone, Braxton, Brooke, Cabell, Calhoun, Clay, Doddridge, Fayette, Gilmer, Greenbrier, Hampshire, Hancock, Hardy, Harrison, Jackson, Kanawha, Lewis, Logan, Marion, Marshall, Mason, McDowell, Mercer, Monongalia, Monroe, Morgan, Nicholas, Ohio, Pendleton, Pleasants, Pocahontas, Preston, Putnam, Raleigh, Randolph, Ritchie, Roane, Taylor, Tucker, Tyler, Upshur, Wayne, Webster, Wetzel, Wirt, Wood, Wyoming.

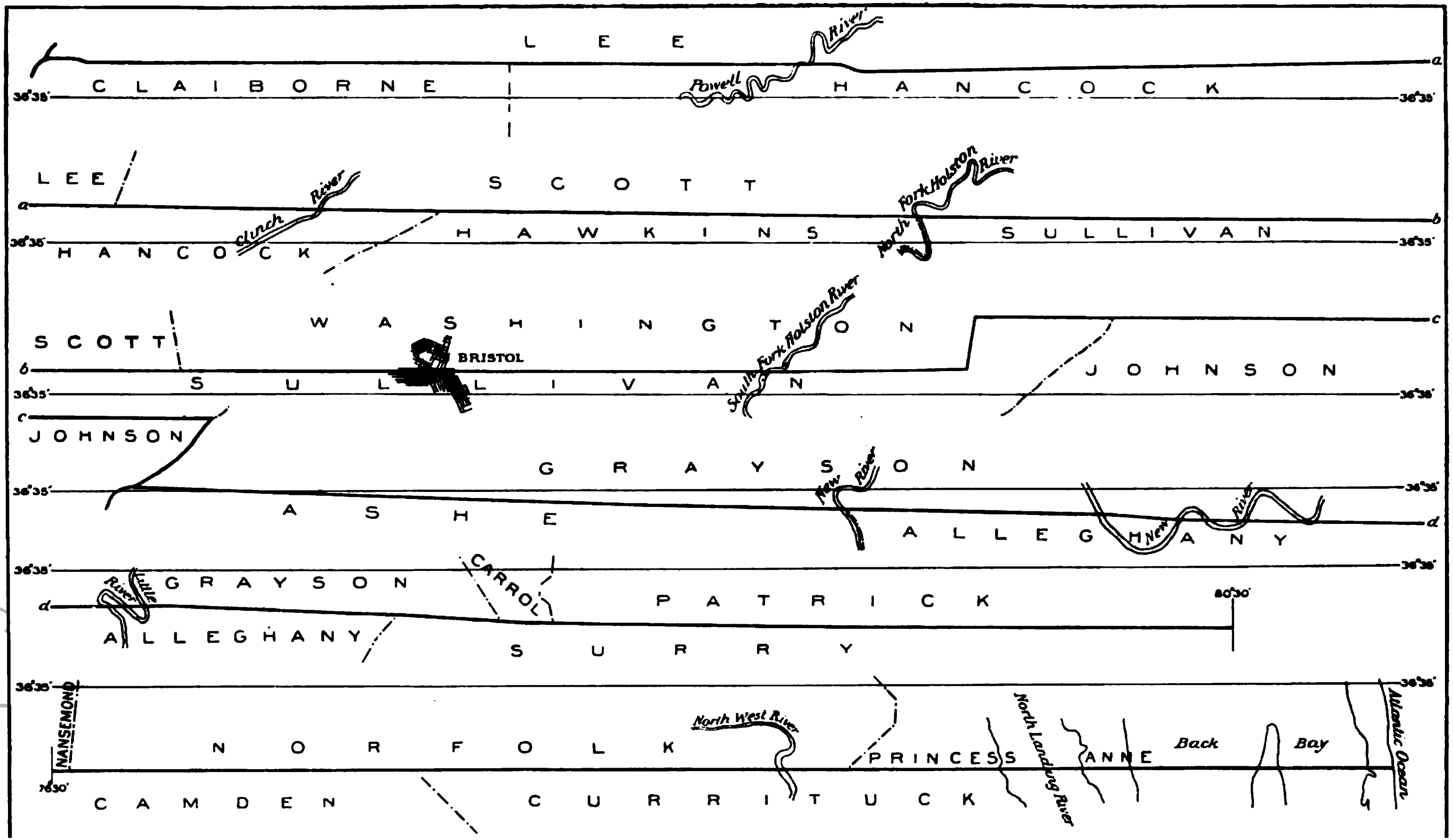
In 1866 it was enlarged by the two counties of Berkeley and Jefferson, transferred from Virginia. Its boundary with Virginia is made up of boundary lines of the border counties above enumerated; and can be defined only by reference to the laws by which these counties were created. In the constitution of 1872, after a recapitulation of the counties which were transferred from Virginia to West Virginia, is found the following clause defining the boundaries upon the south and west:

> The State of West Virginia includes the bed, bank, and shores of the Ohio River, and so much of the Big Sandy River as was formerly included in the Commonwealth of Virginia, and all territorial rights and property in and jurisdiction over the same heretofore reserved by and vested in the Commonwealth of Virginia, are vested in and shall hereafter be exercised by the State of West Virginia; and such parts of the said beds, banks, and shores as lie opposite and adjoining the several counties of this State shall form parts of said several counties respectively.

(For a history of the boundaries of West Virginia, *vide* Pennsylvania, p. 86; Maryland, p. 89; Virginia, p. 95.)

NORTH CAROLINA.

In the year 1663 the "first charter of Carolina" was granted, which, two years later, in 1665, was enlarged by the "second charter of Carolina."


LEE
CLAIBORNE
HANCOCK
Powell River
36°35′
a
LEE
SCOTT
HAWKINS
SULLIVAN
HANCOCK
Clinch River
North Fork Holston River
b
SCOTT
WASHINGTON
SULLIVAN
JOHNSON
BRISTOL
South Fork Holston River
c
JOHNSON
GRAYSON
ASHE
ALLEGHANY
New River
d
GRAYSON
CARROL
PATRICK
ALLEGHANY
SURRY
Little River
80°30′
NANSEMOND
NORFOLK
PRINCESS ANNE
CAMDEN
CURRITUCK
North West River
North Landing River
Back Bay
Atlantic Ocean
76°30′

The following extracts from these two charters define the boundaries:

Charter of Carolina, 1663.

* * * All that territory or tract of ground, scituate, lying and being within our dominions of America, extending from the north end of the island called Lucke Island, which lieth in the Southern Virginia seas, and within six and thirty degrees of the northern latitude, and to the west as far as the south seas, and so southerly as far as the river Saint Matthias, which bordereth on the coast of Florida, and within one and thirty degrees of northern latitude, and so west in a direct line as far as the south seas aforesaid. * * *

Charter of Carolina, 1665.

* * * All that province, territory, or tract of land, scituate, lying or being in our dominions of America, aforesaid, extending north and eastward as far as the north end of Currituck River, or inlet, upon a strait westerly line to Wyonoke Creek, which lies within or about the degrees of thirty-six and thirty minutes, northern latitude, and so west in a direct line as far as the south seas. * * *

This is an extension of the charter of 1663, by which its northern boundary was removed from the approximate latitude of 36° to 36° 30′, on which parallel it is now approximately established. Although the exact year in which the division of the province of Carolina into the two provinces of North and South Carolina appears somewhat uncertain, I find it generally put down as 1729. The division line between the two provinces, North and South Carolina, appears to have been established by mutual agreement.

In the constitution of North Carolina of 1776 this line is defined as shown in the subjoined extract:

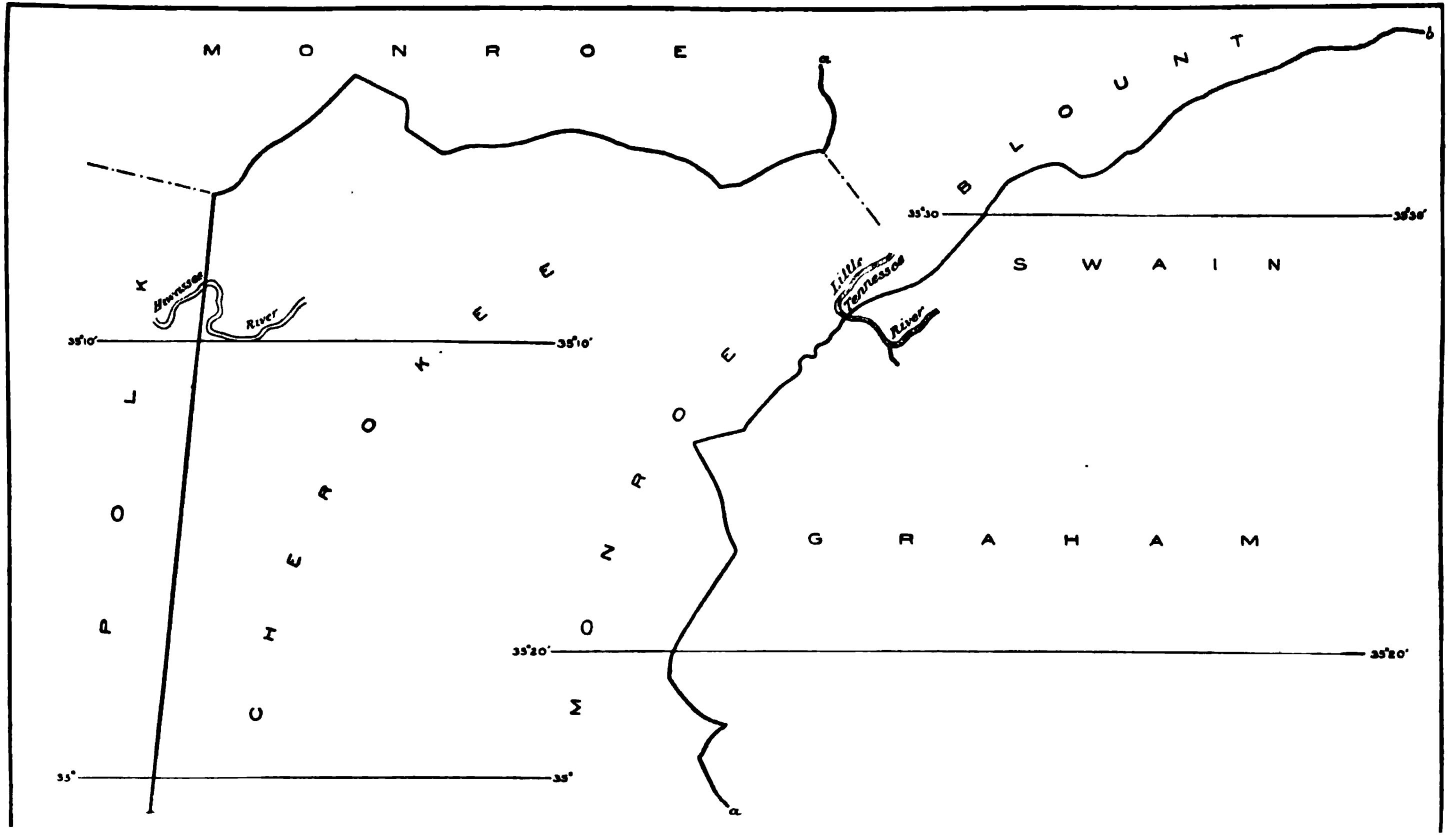
The property of the soil, in a free government, being one of the essential rights of the collective body of the people, it is necessary, in order to avoid future disputes, that the limits of the State should be ascertained with precision; and as the former temporary line between North and South Carolina was confirmed and extended by commissioners appointed by the legislatures of the two States, agreeable to the order of the late King George II in council, that line, and that only, should be esteemed the southern boundary of this State; that is to say, beginning on the sea side at a cedar stake, at or near the mouth of Little River (being the southern extremity of Brunswic County), and running from thence a northwest course through the boundary house, which stands in thirty-three degrees fifty-six minutes, to thirty-five degrees north latitude, and from thence a west course so far as is mentioned in the charter of King Charles II to the late proprietors of Carolina. Therefore, all the territory, seas, waters, and harbours, with their appurtenances, lying between the line above described, and the southern line of the State of Virginia, which begins on the sea shore, in thirty-six degrees thirty minutes north latitude, and from thence runs west, agreeable to the said charter of King Charles, are the right and property of the people of the State, to be held by them in sovereignty, any partial line, without the consent of the legislature of this State, at any time thereafter directed or laid out in anywise notwithstanding.

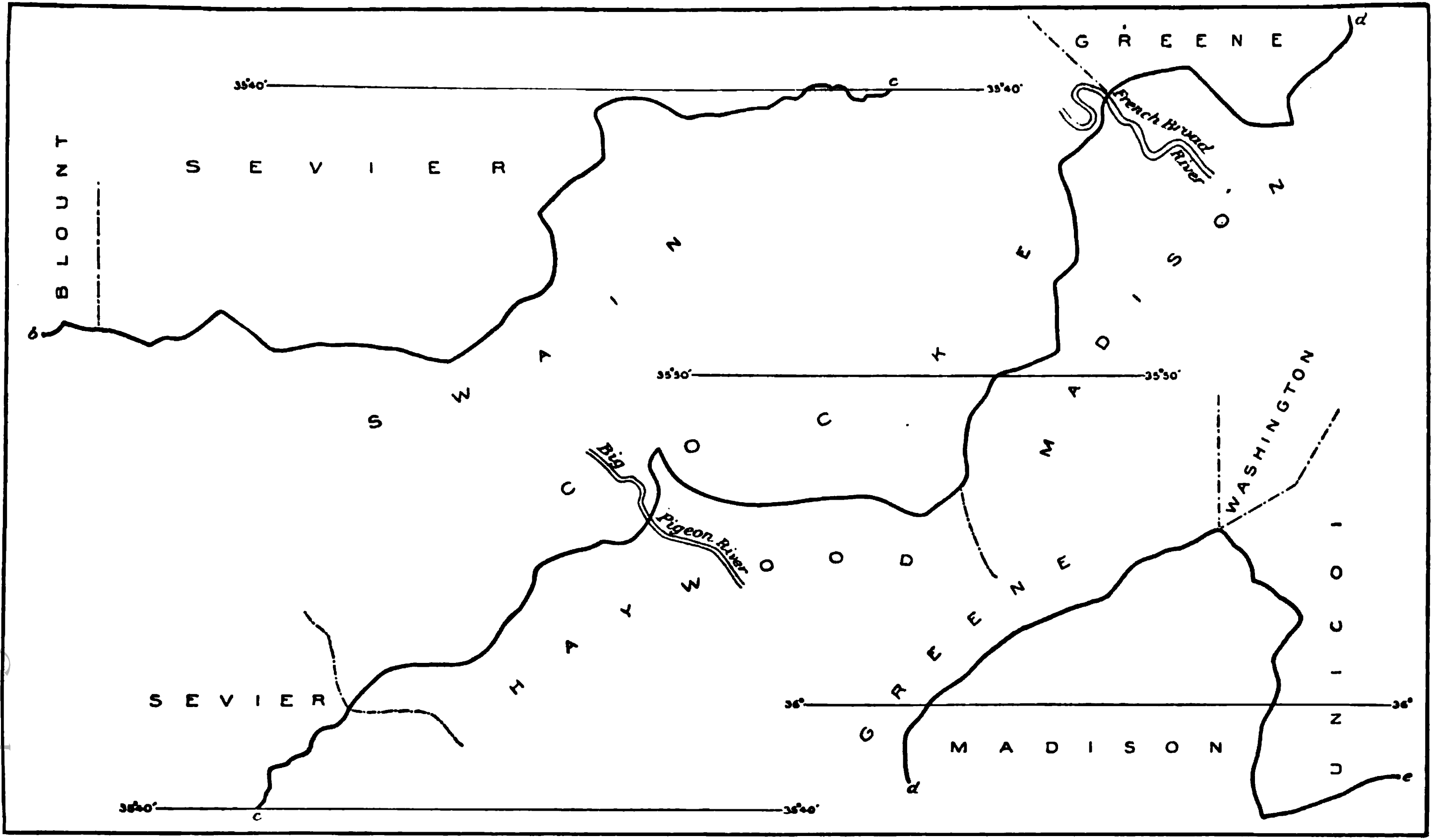
On December 2, 1789, the legislature passed an act ceding to the United States its western lands, now constituting the State of Tennessee. On February 25, 1790, the deed was offered, and on April 2 of the same year it was accepted by the United States.

In the Revised Statutes the north and south boundaries of the State are claimed to be as follows: The northern boundary, the parallel of 36° 30′; the southern boundary, a line running northwest from Goat Island on the coast in latitude 33° 56′ to the parallel of 35°, and thence along that parallel to Tennessee; while the western boundary is the Smoky Mountains. It is strange that the Revised Statutes should contain such a statement of the boundary lines when it is thoroughly well known that it is incorrect, especially as regards the southern boundary. In the case of the northern boundary the intention has been from the earliest colonial times down to the present to establish a line upon the parallel of 36° 30′. This is found to be the wording of every legislative act relating to it, and the errors of this boundary are due simply to errors in surveying and location. The following brief and comprehensive sketch of the north and south boundary lines of this State, and of the various attempts made to locate them, is taken from Professor Kerr's "Geology of North Carolina," vol. I, page 2:

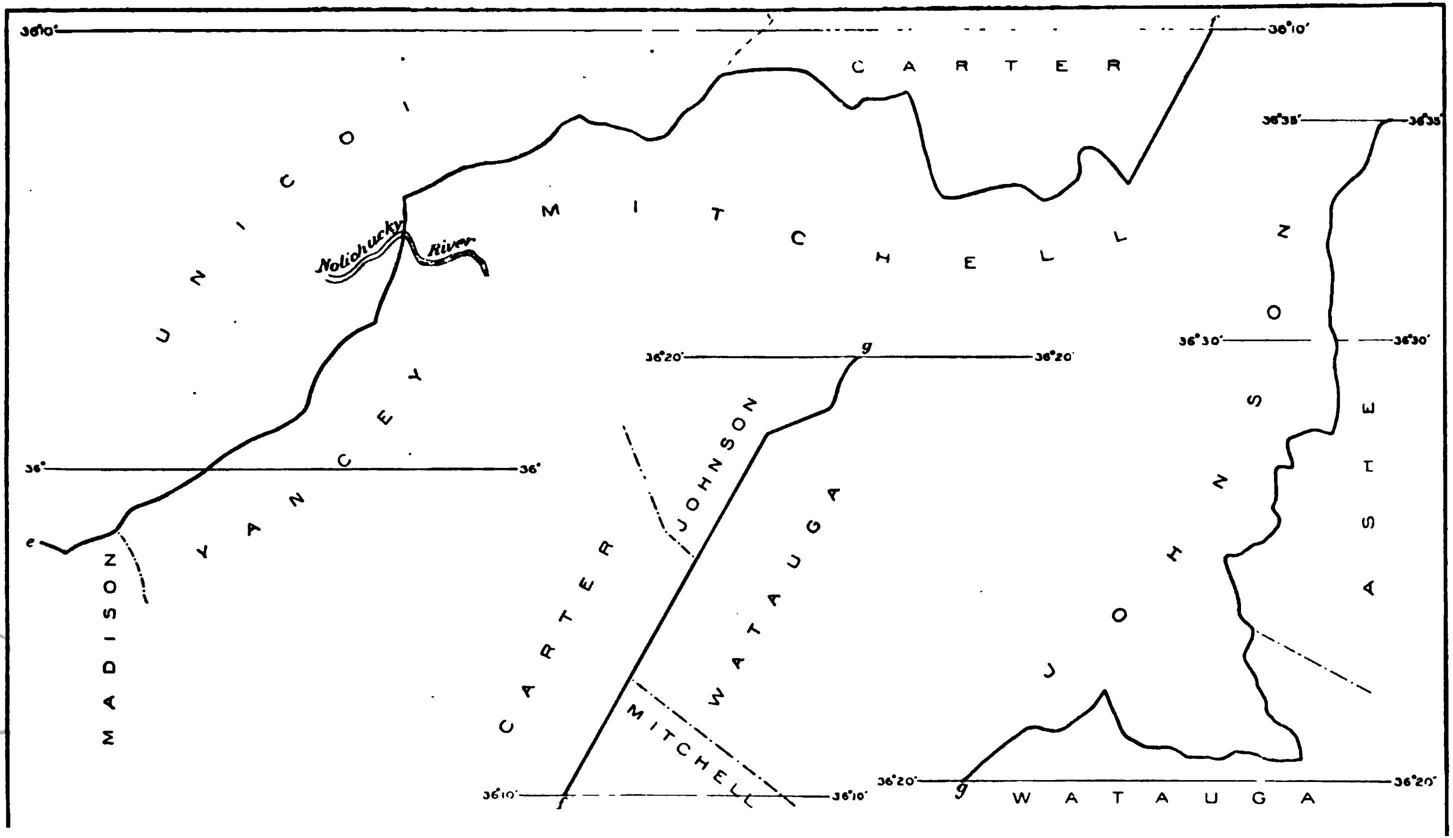
"The first and only serious attempt to ascertain the northern boundary was that made in 1728, by Col. Wm. Byrd, and others, commissioners on the part of the two colonies, acting under Royal authority. From the account given by Byrd of this undertaking, it appears that they started from a point on the coast whose position they determined by observation to be in 36° 31′, north latitude, and ran due west (correcting for the variation of the compass), to Nottoway River, where they made an offset of a half mile to the mouth of that stream, again running west. The line was run and marked 242 miles from the coast, to a point in Stokes County, on the upper waters of the Dan River (on Peter's creek) the North Carolina commissioners accompanying the party only about two-thirds of the distance. Beyond this point, the line was carried some 90 miles by another joint commission of the two colonies in 1749; this survey, terminating at Steep Rock Creek, on the east of Stone Mountain, and near the present northwest corner of the State, was estimated to be 329 miles from the coast. In 1779 the line was taken up again at a point on Steep Rock Creek, determined by observation to be on the parallel of 36° 30′ (the marks of the previous survey having disappeared entirely), and carried west to and beyond Bristol, Tennessee. This last is known as the Walker line, from one of the commissioners of Virginia.

These lines were run and the latitude observations taken with very imperfect instruments, and the variation of the compass was little understood, so that it was not possible to trace a parallel of latitude. The line, besides, was only marked on the trees and soon disappeared, and as the settlements were very scattered the location soon became a matter of vague tradition and presently of contention and litigation, so that in 1858, at the instance of Virginia, commissioners were appointed to relocate the line from the end of the Byrd survey westward, but for some reason they did not act. In 1870 commissioners were again appointed by Virginia and similar action asked on the part of this State; and the proposition was renewed in 1871, but ineffectually, as before. In all these numerous attempts to establish the line of division between the two colonies and States, the intention and the specific instructions have been to ascertain and mark, as the boundary of the two States, *the parallel of* 36° 30′. The maps published towards the end of last century by Jefferson and others give that parallel as the line, and the bill of rights of North Carolina claims that "all the territory lying between the line above described (the line between North and South Carolina) and the southern line of the State of Virginia, which begins on the sea shore in 36° 30′ north latitude, and from thence runs west, agreeably to the


MONROE
BLOUNT
SWAIN
GRAHAM
CHEROKEE
MONROE
POLK
Little Tennessee River
Hiwassee River
35°30'
35°30'
35°20'
35°20'
35°10'
35°10'
35°
35°
a
a
b



BOUNDARY BETWEEN NORTH CAROLINA AND TENNESSEE.


UNICOI
MITCHELL
CARTER
JOHNSON
ASHE
YANCEY
MADISON
CARTER
JOHNSON
WATAUGA
MITCHELL
WATAUGA
Nolichucky River
36°10'
36°10'
36°35'
36°35'
36°30'
36°30'
36°20'
36°20'
36°
36°
36°10'
36°10'
36°20'
36°20'
e
f
f
g
g

charter of King Charles, are the right and property of this State." But it appears from the operations of the United States Coast Survey at both ends of the line that the point of beginning on Currituck Inlet, instead of being, as so constantly assumed, in latitude 36° 30′, or as determined by the surveyors in 1728, 36° 31′ is 36° 33′ 15″, and the western end (of "the Walker line," of 1779, at Bristol, Tenn.) 36° 34′ 25.5″. It is stated in Byrd's Journal that the variation of the compass was ascertained to be a little less than 3° W. [The magnetic chart of the United States Coast Survey would make it 3° E.] And no account is given of any subsequent correction, and if none was made at the end of the line surveyed by him the course would have been in error by nearly 3°, as the amount of variation in this State changes a little more than 1° for every 100 miles of easting or westing. So that the northern boundary of the State as run is not only not the parallel of 36° 30′, but is far from coincident with any parallel of latitude, and must be a succession of curves, with their concavities northward and connected at their ends by north and south offsets.

The southern boundary between this State and South Carolina and Georgia was first established by a joint colonial commission in 1735 to 1746. The commissioners run a line from Goat Island on the coast (in latitude 33° 56′ as supposed) NW to the parallel of 35°, according to their observations, and then due west to within a few miles of the Catawba River, and here, at the old Salisbury and Charleston road, turned north along that road to the southeast corner of the Catawba Indian Lands. This line, resurveyed in 1764, was afterwards (in 1772) continued along the eastern and northern boundaries of the Catawba lands to the point where the latter intersects the Catawba River; thence along and up that river to the mouth of the South Fork of the Catawba, and thence due west, as supposed, to a point near the Blue Ridge. This part of the line was resurveyed and confirmed by commissioners under acts of assembly of 1803, 1804, 1806, 1813, 1814, and 1815, and continued west to and along the Saluda Mountains and the Blue Ridge to the intersection of the "Cherokee boundary" of 1797, and thence in a direct line to the Chatooga River at its intersection with the parallel of 35°. From this point the line was run west to the Tennessee line, between this State and Georgia, in 1807, and confirmed and established by act of 1819.

The boundary between this State and Tennessee was run, according to the course designated in the act of 1789, entitled "An act for the purpose of ceding to the United States certain western lands therein described" (the State of Tennessee); that is, along the crest of the Smoky Mountains, from the Virginia line to the Cataluche River (in Haywood County), in 1799, under act of 1796. It was continued from this point to the Georgia line in 1821. The commissioners who completed this line, at the date last-mentioned, instead of following their instructions, diverged from the crest of the Smoky (Unaka) Mountains at the intersection of the Hiwassee turnpike, and run *due south* to the Georgia line, thereby losing for the State the valuable mining region since known as Ducktown.

And as to the southern boundary, the point of beginning on Goat Island is in latitude 33° 51′ 37″, as shown by the Coast Survey, and instead of running from Goat Island northwest to latitude of 35° and thence along that parallel, it appears, from the South Carolina Geographical State Survey of 1821-'25, that the course from the starting point is N. 47° 30′ W., and instead of pursuing the parallel of 35° it turns west about 10 miles south of that line, and then on approaching the Catawba River, turns northward pursuing a zigzag line to the forks of the Catawba River, which is about 12 miles north of that parallel; and from this point to the mountains the boundary line (of 1772) runs, not west, but N. 88° W., bringing its western end about 17 miles too far north, and reaching the (supposed) parallel of 35° at a distance of about 130 miles east of the Catawba River. The loss of territory resulting from these singular deviations is probably between 500 and 1,000 square miles.

The following extract from the constitution of 1796, of Tennessee, defines the eastern boundary of that State, which is the western boundary of North Carolina, as it was intended to be run and marked:

> Beginning on the extreme height of the Stone Mountain at the place where the line of Virginia intersects it in latitude thirty-six degrees and thirty minutes north; running thence along the extreme height of the said mountain to the place where Watauga River breaks through it; thence a direct course to the top of the Yellow Mountain, where Bright's road crosses the same; thence along the ridge of said mountain between the waters of Doe River and the waters of Rock Creek, to the place where the road crosses the Iron Mountain; from thence along the extreme height of said mountain to where Nolichucky River runs through the same; thence to the top of the Bald Mountain; thence along the extreme height of said mountain to the Painted Rock on French Broad River; thence along the highest ridge of said mountain to the place where it is called the Great Iron or Smoky Mountain; thence along the extreme height of said mountain to the place where it is called Unicoi or Unaka Mountain between the Indian towns of Cowee and Old Chota; thence along the main ridge of the said mountain to the southern boundary of this State as described in the act of cession of North Carolina to the United States of America.

In 1879 the legislature passed an act to appoint commissioners to make a survey from the northeast corner of Georgia westward. This point of commencement is common to North Carolina, South Carolina, and Georgia.

In 1881 the legislature passed another act, providing for the appointment of a commissioner, who should act with commissioners from Virginia, South Carolina, Georgia, or Tennessee, to re-run and re-mark the boundaries between North Carolina and the other States.

SOUTH CAROLINA.

The territory included in the present State of South Carolina was included in the charter of Carolina, which also embraced what is now the State of Georgia. (*Vide* North Carolina, p. 99.)

In 1729 the province of Carolina was divided, forming the two provinces of North Carolina and South Carolina. In 1732 the extent of South Carolina was reduced by the charter of Georgia. (*Vide* Georgia, p. 103.)

(For a history of the settlement of the boundary between North Carolina and South Carolina, *vide* North Carolina, p. 99.)

By the charter of Georgia the line between South Carolina and Georgia was to be the Savannah River, to the head thereof. In 1762 difficulties having arisen, concerning the interpretation of the charter, as regarded the head of the Savannah, and also the title to the lands south of the Altamaha River, Georgia made complaint to the King, who issued a proclamation in 1763 giving the lands between the Altamaha and Saint Mary's Rivers to Georgia. The question of the boundary on the Savannah, however, remained unsettled until 1787, when a convention between the two States was held at Beaufort, S. C., to determine the same, and the line was fixed as at present.

The following is an extract from the articles of agreement:

> The most northern branch or stream of the river Savannah from the sea or mouth of such stream to the fork or confluence of the rivers now called Tugaloo and Keowa, and from thence the most northern branch or stream of the said river Tugaloo till it intersects the northern boundary line of South Carolina, if the said branch or stream of Tugaloo extends so far north, reserving all the islands in the said rivers Savannah and Tugaloo to Georgia; but if the head spring or source of any branch or stream of the said river Tugaloo does not extend to the north boundary line of South Carolina, then a west line to the Mississippi, to be drawn from the head spring or source of the said branch or stream of Tugaloo River which extends to the highest northern latitude, shall forever hereafter form the separation, limit, and boundary between the States of South Carolina and Georgia. (Laws of the United States, Vol. I, p. 466.)

In the same year South Carolina ceded to the United States a narrow strip of territory south of the North Carolina line, which she claimed, about 12 or 14 miles wide, and extending to the Mississippi River; this strip now forms the northern portion of Georgia, Alabama, and Mississippi. Georgia being thus increased in extent northwardly, the line between the two States is clearly expressed in the code of South Carolina, as follows, viz:

> The Savannah River, from its entrance into the ocean to the confluence of the Tugaloo and Keowa Rivers; thence by the Tugaloo River to the confluence of the Tugaloo and Chatooga Rivers; thence by the Chatooga River to the North Carolina line in the thirty-fifth degree of north latitude, the line being low-water mark at the southern shore of the most northern stream of said rivers, where the middle of the rivers is broken by islands, and middle thread of the stream where the rivers flow in one stream or volume.

GEORGIA.

Georgia was included in the proprietary charter granted to the lords proprietors of Carolina in 1663 and 1665, for which a provincial charter was substituted in 1719.

In 1732 the charter of Georgia as an independent colony was granted by King George II, of which the following is an extract:

> All those lands, countrys, and territories situate, lying and being in that part of South Carolina, in America, which lies from the most northern part of a stream or river there, commonly called the Savannah, all along the sea-coast to the southward, unto the most southern stream of a certain other great water or river called the Altamaha, and westerly from the heads of the said rivers, respectively, in direct lines to the south seas.

This charter was surrendered in 1752 and a provincial government established. (C. & C., p. 369 *et seq.*)

In 1763 the territory between the Altamaha and Saint Mary's Rivers was added to Georgia by royal proclamation. (*Vide* South Carolina, p. 102.)

In the constitution adopted by Georgia in 1798 the boundaries are declared. The following is an extract therefrom:

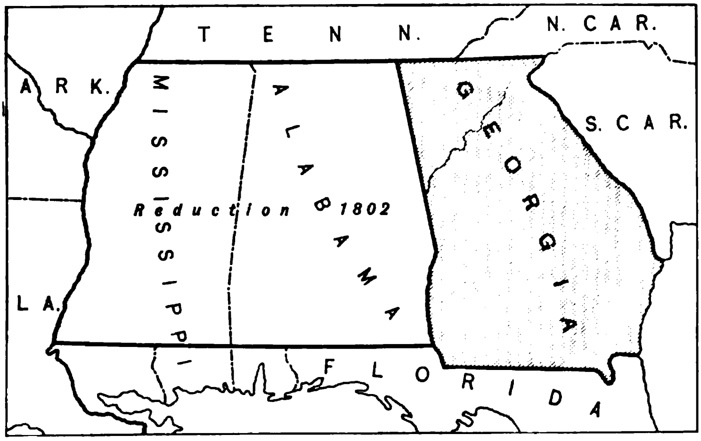
> The limits, boundaries, jurisdictions, and authority of the State of Georgia do, and did, and of right ought to extend from the sea or mouth of the river Savannah along the northern branch or stream thereof, to the fork or confluence of the rivers now called Tugalo and Keowee, and from thence along the most northern branch or stream of the said river Tugalo, till it intersect the northern boundary line of South Carolina, if the said branch or stream of Tugalo extends so far north, reserving all the islands in the said rivers Savannah and Tugalo to Georgia; but if the head, spring, or source of any branch or stream of the said river Tugalo does not extend to the north boundary line of South Carolina, then a west line to the Mississippi, to be drawn from the head, spring, or source of the said branch or stream of Tugalo River, which extends to the highest northern latitude; thence down the middle of the said river Mississippi, until it shall intersect the northernmost part of the thirty-first degree of north latitude, south by a line drawn due east from the termination of the line last mentioned, in the latitude of thirty-one degrees north of the equator, to the middle of the river Apalachicola or Chatahoochee; thence along the middle thereof, to its junction with Flint River; thence straight to the head of Saint Mary's River, and thence, along the middle of Saint Mary's River, to the Atlantic Ocean, and from thence to the mouth or inlet of Savannah River, the place of beginning, including and comprehending all the lands and waters within the said limits, boundaries, and jurisdictional rights; and also all the islands within twenty leagues of the sea-coast.

In 1802 Georgia entered into articles of agreement and cession with the United States, whereby Georgia ceded to the United States the lands west of her present boundaries, and the United States ceded to Georgia that part of the South Carolina cession of 1787 which lies east of the present western boundary of Georgia. The following extracts show the limits of the two cessions:

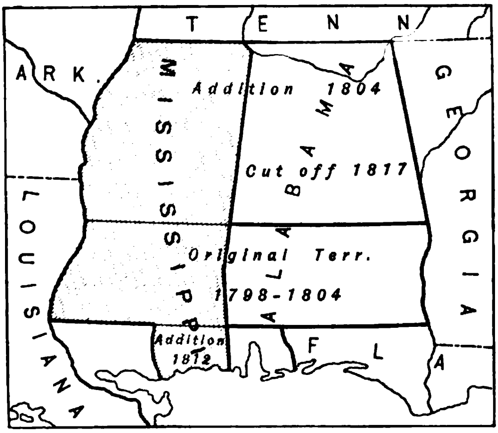
> The State of Georgia cedes to the United States all the right, title, and claim which the said State has to the jurisdiction and soil of the lands situated within the boundaries of the United States, south of the State of Tennessee and west of a line beginning on the western bank of the Chatahouchee River where the same crosses the boundary line between the United States and Spain; running thence up the said river Chatahouchee, and along the western bank thereof to the great bend thereof, next above the place where a certain creek or river, called "Uchee" (being the first considerable stream on the western side, above the Cussetas and Coweta towns), empties into the said Chatahouchee River; thence in a direct line to Nickajack, on the Tennessee River; thence crossing the said last-mentioned river, and thence running up the said Tennessee River and along the western bank thereof to the southern boundary line of the State of Tennessee.
>
> * * * * * * *
>
> The United States * * * cede to the State of Georgia * * * the lands * * * situated south of the southern boundaries of the States of Tennessee, North Carolina, and South Carolina, and east of the boundary line herein above described as the eastern boundary of the territory ceded by Georgia to the United States.

For a history of the boundary between Georgia and South Carolina, *vide* South Carolina, p. 102.

The history of the boundary between North Carolina and Georgia has already been given (*vide* North Carolina, p. 101). It may be proper, however, to add that this line (the thirty-fifth degree of north latitude) was fixed by the cession above detailed, from the United States to Georgia



HISTORICAL DIAGRAM OF GEORGIA.



HISTORICAL DIAGRAM OF MISSISSIPPI.

of that part of the South Carolina cession east of the present western boundary of Georgia.

A long controversy ensued between Georgia and North Carolina, with no results, however, until in 1810 Georgia empowered her governor to employ Mr. Andrew Ellicott to ascertain the true location of the thirty-fifth degree of latitude. Ellicott did so, and the point fixed by him was acquiesced in. (*Vide* Cobb's Georgia Digest, p. 150.)

The boundary between Georgia and Tennessee was established in 1818, and is as follows, viz: The thirty-fifth parallel of north latitude, beginning and ending as follows:

> Beginning at a point in the true parallel of the thirty-fifth degree of north latitude, as found by James Cormack, mathematician on the part of the State of Georgia, and James S. Gaines, mathematician on the part of the State of Tennessee, on a rock about two feet high, four inches thick, and fifteen inches broad, engraved on the north side thus: "June 1st, 1818; var. 6¾ east," and on the south side thus: "Geo. 35 North; J. Cormack," which rock stands one mile and twenty-eight poles from the south bank of the Tennessee River, due south from near the center of the old Indian town of Nickajack, and near the top of the Nickajack Mountain, at the supposed corner of the State of Georgia and Alabama; thence running due east, leaving old D. Ross two miles and eighteen yards in the State of Tennessee, and leaving the house of John Ross about two hundred yards in the State of Georgia, and the house of David McNair one mile and one-fourth of a mile in the State of Tennessee, with blazed and mile-marked trees, lessening the variation of the compass by degrees, closing it at the termination of the line on the top of the Unicoi Mountain at five and one-half degrees. (*Vide* C. Stat. of Tenn., pp. 243-244.)

The boundary between Georgia and Florida was fixed by the treaty of 1783, between the United States and Great Britain, substantially as at present, viz: Commencing in the middle of the Apalachicola or Catahouche River, on the thirty-first degree of north latitude; thence along the middle thereof to its junction with the Flint River; thence straight to the head of Saint Mary's River, and thence down along the middle of Saint Mary's River to the Atlantic ocean (*vide* Treaty of 1783). This boundary was affirmed by the treaty of 1795 between the United States and Spain, and commissioners were appointed to run the entire line between the United States and the Spanish territory. (*Vide* Treaty of 1795.)

In 1819 Spain ceded the Floridas to the United States. In 1822 Florida was made a Territory and in 1825 was admitted into the Union as an independent State.

In 1826 Congress took action as indicated below:

UNITED STATES STATUTES AT LARGE, NINETEENTH CONGRESS, SESSION I, 1826.

AN ACT to authorise the President of the United States to run and mark a line dividing the Territory of Florida from the State of Georgia.

> The line shall be run straight from the junction of said rivers Chatahoochie and Flint, to the point designated as the head of Saint Mary's River.

This boundary line was long unsettled, a controversy arising concerning the true point to be considered to be the head of the Saint Mary's

River, as Georgia contended that the point fixed upon by the Spanish and American commissioners under the treaty of 1795 was incorrect. This line was run in 1825 by the General Land Office.

In 1859 commissioners were appointed by Georgia and Florida to rerun the line. Florida ratified their report in 1861, and Georgia in 1866.

The detailed report of the commissioners is not at hand, but the line is declared in the statutes of Georgia as follows, viz:

> From a point on the western bank of the Chattahoochee River in the 31st degree of north latitude; thence along the line or limit of high-water mark to its junction with the Flint River; thence along a certain line of survey made by Gustavus J. Orr, a surveyor on the part of Georgia, and W. Whitner, a surveyor on the part of Florida, beginning at a four-and-aft tree, about four chains below the present junction; thence along this line east, to a point designated thirty-seven links north of Ellicott's Mound on the St. Mary's River; thence along the middle of said river to the Atlantic Ocean. (*Vide* Code of Ga., 1873, p. 7.)

This line is also given in the code of Florida, and differs in one respect, viz, from the thirty-first degree of north latitude down the middle of said river to its confluence with the Flint River, etc. (*Vide* Code of Florida, 1872.)

The line between Georgia and Alabama was fixed by the act of cession of Georgia to the United States in 1802.

In 1822–'25, Georgia desiring to have the line run from the Chattahoochee to where it strikes the Tennessee line, appointed commissioners for that purpose, and requested the co-operation of Alabama and the United States, both, however, failing to take action. The Georgia commissioners ran the line from Nickajack, on the Tennessee line, to Miller's Bend, on the Chattahoochee. (For a history of the controversy concerning this line, *vide* laws of Georgia, 1822–'24–'25–'26.)

Alabama protested against the above line and made repeated efforts to reopen negotiations concerning it, to all of which Georgia sturdily refused to accede, until finally, January 24, 1840, the legislature of Alabama passed the following joint resolution, viz:

> *Resolved*, That the State of Alabama will, and do, hereby accept, as the true dividing line between this State and that of Georgia, the line which was run and marked out by the commissioners of Georgia in 1826, beginning at what is called Miller's Bend, on the Chattahoochee River; thence along said marked line to Nickajack.

The line is given in the code of Alabama in the following words, viz:

> The boundary line between Alabama and Georgia commences on the west side of the Chattahoochee River at the point where it enters the State of Florida; from thence up the river, along the western bank thereof, to the point on Miller's Bend next above the place where the Uchee Creek empties into such river; thence in a direct line to Nickajack. (See code of Alabama, 1876, p. 189.)

In James's Hand-book of Georgia, 1876, p. 121, is the following description of the western boundary of Georgia, viz:

> From Nickajack the line between Georgia and Alabama runs south 9° 30′ east to Miller's Bend, on the Chattahoochee River, about 146 miles; thence down the western bank of the river at high-water mark to its junction with Flint River, at a point now four chains below the actual junction, latitude 30° 42′ 42″, longitude 80° 53′ 15″.

FLORIDA.

Florida was originally settled by the Spaniards, and was held as a Spanish province nearly two hundred years. In 1762 it was ceded by Spain to Great Britain, who divided it into the two provinces of East and West Florida, separated by the Apalachicola River, with a northern boundary substantially as at present. (*Vide* Fairbanks' History of Florida.)

In 1783 Great Britain retroceded Florida to Spain, and the northern boundary was fixed by the treaty of peace between the United States and Great Britain signed in the same year. Spain, however, claimed the territory as far north as the parallel of latitude of the mouth of the Yazoo River.

Previous to this, in 1763, France had ceded Louisiana to Spain, which Spain retroceded to France in 1800, and in 1803 France ceded the same to the United States, who claimed that the eastern boundary of the said province of Louisiana, so often ceded, was the Perdido River, while Spain claimed it to be the Iberville River and Lakes Maurepas and Pontchartrain. The controversy arising from the difference of interpretation of these various treaties and cessions was terminated by the treaty of Washington in 1819, whereby Spain ceded to the United States the provinces of East and West Florida.

On March 30, 1822, by an act of Congress, the territory ceded to the United States by Spain was made the "Territory of Florida," embracing the same extent as does the present State.

On March 3, 1845, Florida was admitted into the Union as an independent State.

(For a history of the northern boundary of Florida *vide* Georgia, p. 105.)

In 1831 Congress passed an act relating to the boundary between Florida and Alabama, of which the following is an extract:

AN ACT to ascertain and mark the line between the State of Alabama and the Territory of Florida, and the northern boundary of the State of Illinois, and for other purposes.

That the President of the United States be, and he is hereby, authorized to cause to be run and marked the boundary line between the State of Alabama and the Territory of Florida, by the surveyors-general of Alabama and Florida, on the thirty-first degree of north latitude.

* * * * * * *

(*Vide* U. S. Stat. at Large, Vol. IV, p. 479.)

In 1847 the agreement of commissioners previously appointed by Florida and Alabama was ratified, and the line is described as follows, viz:

Commencing on the Chattahoochee River near a place known as "Irwin's Mills" and running west to the Perdido, marked throughout by blazes on the trees, and also by mounds of earth thrown up on the line at distances of one mile, more or less, from each other, and commonly known as "Ellicott's Line," or the "Mound Line." (*Vide* Florida Code, 1873, p. 100.)

This line was run in 1799–1800 by A. Ellicott. The line was retraced, remeasured. and marked in 1853–54.

The line between the two States is given in general terms in the Florida Code as follows, viz:

> Commencing at the mouth of the Perdido River, from thence up the middle of said river to where it intersects the south boundary line of the State of Alabama and the thirty-first degree of north latitude; then due east to the Chattahoochee River.

ALABAMA.

In 1798 the United States formed the Territory of Mississippi, including—

> All that tract of country bounded on the west by the Mississippi, on the north by a line to be drawn due east from the mouth of the Yazous to the Chattahouchee River, on the east by the Chattahouchee River, and on the south by the thirty-first degree of north latitude. (*Vide* U. S. Stat. at Large, Vol. I, p. 549.)

In this act was a clause reserving the right of Georgia and of individuals to the jurisdiction of the soil thereof.

South Carolina and Georgia having ceded to the United States their claim to territory west of their present limits, the General Government, in 1804, by an act of Congress, annexed the tract of country lying north of Mississippi Territory and south of the State of Tennessee, and bounded on the east by Georgia and west by Louisiana, to the Territory of Mississippi. (*Vide* U. S. Stat. at Large, Vol. II, p. 305.) Also in 1812 the United States added to Mississippi Territory all the lands lying east of Pearl River, west of the Perdido and south of the thirty-first degree of latitude. (*Vide* U. S. Stat. at Large, Vol. II, p. 734.)

By these additions the Territory of Mississippi was made to comprise what is now included in the two States of Alabama and Mississippi. On March 8, 1817, by an act of Congress the Territory of Alabama was formed from the eastern portion of the Territory of Mississippi, with the following boundaries, viz:

> Beginning at the point where the line of the thirty-first degree of north latitude intersects the Perdido River; thence east to the western boundary line of the State of Georgia; thence along said line to the southern boundary line of the State of Tennessee; thence west along said boundary line to the Tennessee River; thence up the same to the mouth of Bear Creek; thence by a direct line to the northwest corner of Washington County; thence due south to the Gulf of Mexico; thence, eastwardly, including all the islands within 6 leagues of the shore, to the Perdido River; and thence up the same to the beginning. (*Vide* U. S. Stat. at Large, Vol. III, p. 371.)

On December 14, 1819, Alabama was admitted as an independent State, with the above boundaries. It was, however, made the duty of the surveyor of the public lands south of Tennessee and the surveyor of lands in Alabama Territory to run and cut out the line of demarcation between the two States of Alabama and Mississippi, and if it should appear to said surveyors that so much of the line designated as running due south from the northwest corner of Washington County to the Gulf of Mexico should encroach on the counties of Wayne, Greene, and Jackson, in the State of Mississippi, then the same should be altered so as to run in a direct line from the northwest corner of Washington County to a point on the Gulf of Mexico 10 miles east of the mouth of the River Pascagoula. (*Vide* U. S. Stat. at Large, Vol. III, p. 490.) This line was run and marked in 1820.

(For the history of the boundaries between Alabama and Georgia *vide* Georgia, p. 106. For the history of the boundaries between Alabama and Florida *vide* Florida, p. 107.)

The boundary between Alabama and Tennessee is the thirty-fifth parallel of north latitude (*vide* North Carolina, p. 101); from Nickajack (*vide* Georgia, p. 104) west across the Tennessee River, and on to the second intersection of said river by said parallel. (*Vide* Alabama Code, 1876, p. 189.)

The boundary between Alabama and Mississippi was to be run by surveyors, under the act of admission of Alabama. The report of said surveyors is not at hand, but the line as laid down in the Mississippi Code is as follows, viz:

> Beginning at a point on the west bank of the Tennessee River, six four-pole chains south of, and above, the mouth of Yellow Creek; thence up the said river to the mouth of Bear Creek; thence by a direct line to what was formerly the northwest corner of Washington County, Alabama; thence in a direct line to a point ten miles east of the Pascagoula River, on the Gulf of Mexico. (*Vide* Mississippi Code, pp. 48, 49).

MISSISSIPPI.

(For the early history of the extent of Mississippi Territory *vide* Alabama, p. 108.)

On December 10, 1817, the western part of the Mississippi Territory was made a State and admitted into the Union, with the following boundaries, viz:

> Beginning on the river Mississippi at the point where the southern boundary of the State of Tennessee strikes the same; thence east along the said boundary line to the Tennessee River; thence up the same to the mouth of Bear Creek; thence by a direct line to the northwest corner of the county of Washington; thence due south to the Gulf of Mexico; thence westwardly, including all the islands within six leagues of the shore, to the most eastern junction of Pearl River with Lake Borgne; thence up said river to the thirty-first degree of north latitude; thence west along said degree of latitude to the Mississippi River; thence up the same to the beginning. (*Vide* U. S. Stat. at Large, Vol. III, p. 348.)

(For further information concerning eastern boundary, *vide* Alabama, p. 108.)

In 1819 the line between Mississippi and Tennessee was run by commissioners. Their report is not at hand. In 1833 the legislature of

Tennessee passed an act establishing "Thompson's line." The details of "Thompson's line" have not been found. In 1837 the line was again run by commissioners from the two States, and ratified by the legislatures. The commissioners' report was as follows, viz:

Commencing at a point on the west bank of the Tennessee River six four-pole chains south, or above the mouth of Yellow Creek, and about three-quarters of a mile north of the line known as "Thompson's line," and twenty-six chains and ten links north of Thompson's line at the basis meridian of the Chickasaw surveys, and terminating at a point on the east bank of the Mississippi River (opposite Cow Island) sixteen chains north of Thompson's line. (See Laws of Tennessee, 1837, p. 27.)

The boundaries were fixed by the act of Congress admitting the State of Mississippi, as follows, viz:

Commencing at the most eastern junction of Pearl River with Lake Borgne, thence up said Pearl River to the thirty-first degree of north latitude, thence west along said degree of latitude to the Mississippi River, thence up the same to the point where the southern boundary of Tennessee strikes the same. (See U. S. Laws, vol. 6, p. 175.)

Mississippi claims to the middle of the Mississippi River, where the river forms her western boundary. (See Rev. Stat., 1857.)

LOUISIANA.

The original territory of Louisiana was acquired from France (see p. 21). In 1804, a portion of this, comprising the area of the present State of Louisiana, with the exception of the southeastern portion immediately adjoining the present State of Florida, was organized into a territory under the name of Orleans, while the balance of the Louisiana purchase retained the name of Louisiana Territory. On April 30, 1812, the Territory of Orleans was admitted as a State under the name of Louisiana, and at the same time the name of the Territory of Louisiana was changed to Missouri Territory. In the same year the limits of the State were enlarged in the southeast to its present boundaries.

The following act defines the Territory of Orleans:

All that portion of country ceded by France to the United States, under the name of Louisiana, which lies south of the Mississippi territory, and of an east and west line to commence on the Mississippi River at the thirty-third degree of north latitude, and to extend west to the western boundary of the said cession, shall constitute a Territory of the United States, under the name of the Territory of Orleans. (Eighth Congress, first session.)

The following clause from the act admitting Louisiana defines its original boundaries:

Beginning at the mouth of the river Sabine, thence by a line to be drawn along the middle of said river, including all islands, to the thirty-second degree of latitude; thence due north to the northernmost part of the thirty-third degree of north latitude; thence along the said parallel of latitude to the river Mississippi; thence down

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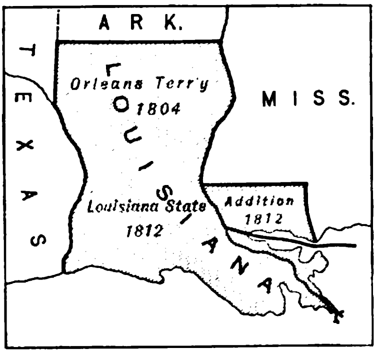
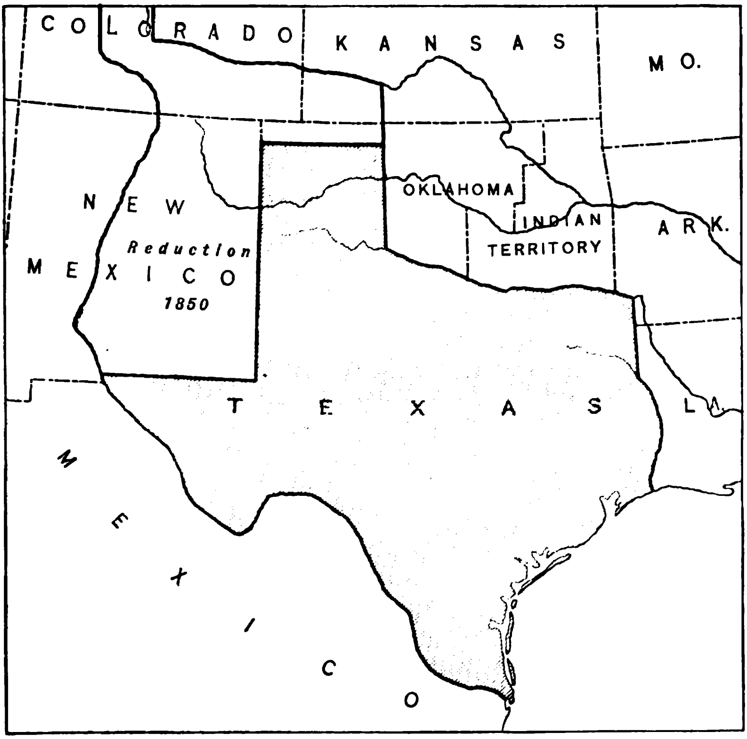


HISTORICAL DIAGRAM OF LOUISIANA.



HISTORICAL DIAGRAM OF TEXAS.

the said river to the river Iberville; and from thence along the middle of the said river and lakes Maurepas and Pontchartrain to the Gulf of Mexico; thence, bounded by the said Gulf, to the place of beginning, including all islands within three leagues of the coast. (Twelfth Congress, first session.)

The following is a description of the addition to the State of Louisiana, in terms of the act:

Beginning at the Junction of the Iberville with the river Mississippi, thence along the middle of the Iberville, the river Amite, and of the lakes Maurepas and Pontchartrain, to the eastern mouth of the Pearl River; thence up the eastern branch of Pearl River to the thirty-first degree of north latitude; thence along the said degree of latitude to the river Mississippi; thence down the said river to the place of beginning, shall become and form a part of the State of Louisiana. (Twelfth Congress, first session.)

The north boundary of Louisiana was surveyed by a joint commission of the State and the United States.

TEXAS.

Texas declared its independence of Mexico in 1835. On December 29, 1845, it was admitted to the Union. As originally constituted, it embraced besides its present area the region east of the Rio Grande, now in New Mexico, extending north to the forty-second parallel, its eastern limits coinciding with the western limit of the United States, as laid down in the treaty with Spain of 1819. (See "Texas accession," p. 24.)

In 1848, the eastern boundary of the State was extended slightly, as noted in the following act:

Be it enacted by the Senate and House of Representatives of the United States of America in Congress assembled, That this Congress consents that the legislature of the State of Texas, may extend her eastern boundary so as to include within her limits one-half of Sabine Pass, one-half of Sabine Lake, also one-half of Sabine River, from its mouth as far north as the thirty-second degree of north latitude.

In 1850, the State sold to the General Government for the sum of $10,000,000, that part lying north of the parallel of 36° 30′, and that portion lying west of longitude 103°, as far south as the parallel of 32°, as set forth in the following clause from the act of Congress relating to this transfer:

First. The State of Texas will agree that her boundary on the north shall commence at the point at which the meridian of one hundred degrees west from Greenwich is intersected by the parallel of thirty-six degrees thirty minutes north latitude, and shall run from said point due west to the meridian of one hundred and three degrees west from Greenwich; thence her boundary shall run due south to the thirty-second degree of north latitude; thence on the said parallel of thirty-two degrees of north latitude to the Rio Bravo del Norte, and thence with the channel of said river to the Gulf of Mexico. (Thirty-first Congress, first session.)

The following act defines the northern boundary of Texas:

AN ACT to authorize the President of the United States, in conjunction with the State of Texas, to run and mark the boundary lines between the Territories of the United States and the State of Texas.

Beginning at the point where the one hundredth degree of longitude west from Greenwich crosses Red River, and running thence north to the point where said one hundredth degree of longitude intersects the parallel of thirty-six degrees thirty minutes north latitude, and thence west with the said parallel of thirty-six degrees and thirty minutes north latitude to the point where it intersects the one hundred and third degree of longitude west from Greenwich; and thence south with the said one hundred and third degree of longitude to the thirty-second parallel of north latitude; and thence west with said thirty-second degree of north latitude to the Rio Grande. (Thirty-fifth Cong., first session.)

The boundary line of Texas is as follows: Beginning in the Gulf of Mexico, at the outlet of Sabine Lake, the line passes northward through the middle of Sabine Lake and up the middle of Sabine River to the point where said river intersects the parallel of 32°; thence north along the meridian of that point of intersection to the point where said meridian intersects Red River; thence up Red River to the one hundredth meridian west of Greenwich; thence north on said meridian to the parallel of 36° 30′; west on said parallel to the meridian of 103° west of Greenwich; thence south on said meridian to the parallel of latitude of 32°; thence west on that parallel to its point of intersection with the Rio Grande; thence down the mid-channel of the Rio Grande to its mouth.

That portion of the east boundary between Red River and the Sabine was run and marked by a joint commission of the United States and Texas in 1841.

The boundary lines between Texas and New Mexico were run and marked in 1859–60, under the Department of the Interior.

ARKANSAS.

The Territory of Arkansas, or Arkansaw, as it was originally spelled, was formed on March 2, 1819, from a part of Missouri Territory. The following clause from the act establishing it defines its limits in part:

All that part of the Territory of Missouri which lies south of a line beginning on the Mississippi River at thirty-six degrees north latitude, running thence west to the river St. François, thence up the same to thirty-six degrees thirty minutes north latitude, and thence west to the western Territorial boundary line, shall, for the purposes of a Territorial government, constitute a separate Territory and be called the Arkansaw Territory.

In 1824 an act was passed by Congress fixing the western boundary of the Territory. This was as follows:

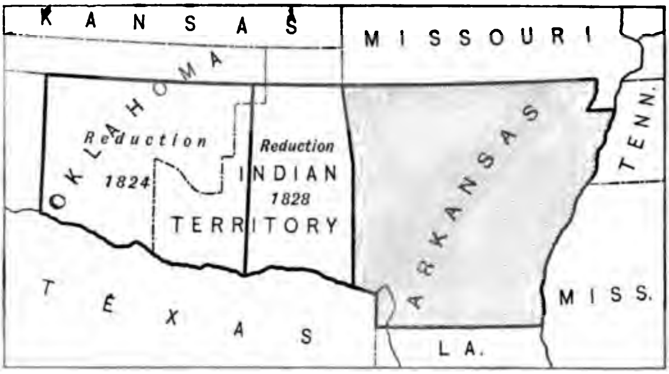
AN ACT to fix the western boundary line of the Territory of Arkansas, and for other purposes.

The western boundary line of the Territory of Arkansas shall begin at a point forty miles west of the southwest corner of the State of Missouri and run south to the right bank of the Red River, and thence down the river and with the Mexican boundary to the line of the State of Louisiana.

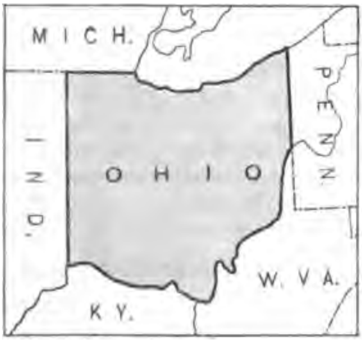
Four years later, in 1828, the following act was passed defining its southern boundary:

AN ACT to authorize the President of the United States to run and mark a line dividing the Territory of Arkansas from the State of Louisiana.

Commencing on the right bank of the Mississippi River at latitude thirty-three degrees north and running due west on that parallel of latitude to where a line running due north from latitude thirty-two degrees north on the Sabine River will intersect the same.



HISTORICAL DIAGRAM OF ARKANSAS.



HISTORICAL DIAGRAM OF OHIO.

The south boundary was originally run in 1823, and again in 1843–45, by a joint commission of the two States of Arkansas and Missouri.

The same year the following treaty changed materially the western line of the Territory, placing it in its present position:

TREATY WITH THE CHEROKEE INDIANS MAY 28, 1828.

ARTICLE 1. The western boundary of Arkansas shall be, and the same is, hereby defined, viz: A line shall be run, commencing on Red River at the point where the Eastern Choctaw line strikes said river, and run due north with said line to the river Arkansas; thence in a line to the southwest corner of Missouri.

The Eastern Choctaw line, referred to above, starts on the Arkansas River "one hundred paces west of Fort Smith, and thence due south to the Red River." (Treaty with Choctaw Nation, January 20, 1825.)

This part of the west boundary was run and marked in 1825, and that part from Fort Smith to the southwestern corner of Missouri in 1831. The entire western boundary was resurveyed and re-marked in 1877.

Arkansas was admitted as a State June 15, 1836.

The following extracts from the enabling act, and from various constitutions, give statements of the boundaries, differing slightly from one another, but, for the most part, only in wording:

CONSTITUTION OF ARKANSAS, 1836.

Beginning in the middle of the main channel of the Mississippi River on the parallel of 36 degrees north latitude; running from thence west with the parallel of latitude to the Saint Francis River; thence up the middle of the main channel of said river to the parallel of thirty-six degrees thirty minutes north; from thence west to the southwest corner of the State of Missouri; and from thence to be bounded on the west to the north bank of Red River, as by acts of Congress and treaties heretofore defining the western limits of the Territory of Arkansas, and to be bounded on the south side of Red River by the Mexican boundary line to the northwest corner of the State of Louisiana; thence east by the Louisiana State line to the middle of the main channel of the Mississippi River; thence up the middle of the main channel of said river to the thirty-sixth degree of north latitude, the point of beginning.

Again, in the enabling act for Arkansas, 1836 (Twenty-fourth Congress, first session), the boundaries are found to be defined as follows:

Beginning in the middle of the main channel of the Mississippi River, on the parallel of thirty-six degrees north latitude, running from thence west, with the said parallel of latitude, to the St. Francis River; thence up the middle of the main channel of said river to the parallel of thirty-six degrees thirty minutes north; from thence west to the southwest corner of the State of Missouri; and from thence to be bounded on the west, to the north bank of Red River, by the line described in the first article of the treaty between the United States and the Cherokee Nation of Indians, west of the Mississippi, made and concluded at the city of Washington, on the twenty-sixth day of May, in the year of our Lord one thousand eight hundred and twenty-eight; and to be bounded on the south side of Red river by the Mexican boundary line to the northwest corner of the State of Louisiana; thence east with the Louisiana State line to the middle of the main channel of the Mississippi River; thence up the middle of the main channel of the said river to the thirty-sixth degree of north latitude, the point of beginning.

In the constitution of 1864 the boundaries are defined as follows:

> Beginning in the middle of the Mississippi River, on the parallel of thirty-six degrees north latitude, to the St. Francis River; thence up the middle of the main channel of said river to the parallel of thirty-six degrees thirty minutes north, thence west to the southwest corner of the State of Missouri; and from thence to be bounded on the west to the north bank of Red River, as by acts of Congress of the United States, and the treaties heretofore defining the western limits of the Territory of Arkansas; and to be bounded on the south side of Red River by the boundary line of the State of Texas, to the northwest corner of the State of Louisiana; thence east with the Louisiana State line to the middle of the main channel of the Mississippi River; thence up the middle of the main channel of said river to the thirty-sixth degree of north latitude, the point of beginning.

The constitution of 1868 differs but slightly from the last. It is as follows:

> Beginning at the middle of the main channel of the Mississippi River, on the parallel of 36° north latitude, running from thence west, with the said parallel of latitude, to the Saint Francis River; thence up the middle of the main channel of said river to the parallel of 36° 30′ north; from thence west with the boundary line of the State of Missouri to the southwest corner of that State; and thence to be bounded on the west to the north bank of Red River, as by acts of Congress and treaties heretofore defining the western limits of the Territory of Arkansas; and to be bounded on the south side of Red River by the boundary line of the State of Texas to the northwest corner of the State of Louisiana; thence east with the Louisiana State line to the middle of the main channel of the Mississippi River; thence up the middle of the main channel of said river, including an island in said river known as "Belle Point Island," to the 36° of north latitude, the place of beginning.

In the constitution of 1874 there are again slight differences, mainly in wording.

> Beginning at the middle of the main channel of the Mississippi River, on the parallel of thirty-six degrees of north latitude; running thence west with said parallel of latitude to the middle of the main channel of the Saint Francis River; thence up the main channel of said last-named river to the parallel of thirty-six degrees thirty minutes of north latitude; thence west with the southern boundary line of the State of Missouri to the southwest corner of said last-named State; thence to be bounded on the west to the north bank of Red River, as by act of Congress and treaties existing January 1, 1837, defining the western limits of the Territory of Arkansas and to be bounded across and south of Red River by the boundary line of the State of Texas as far as to the northwest corner of the State of Louisiana; thence easterly with the northern boundary line of said last-named State, to the middle of the main channel of the Mississippi River; thence up the middle of the main channel of said last-named river, including an island in said river known as "Belle Point Island," and all other land originally surveyed and included as a part of the Territory or State of Arkansas to the thirty-sixth degree of north latitude, the place of beginning.

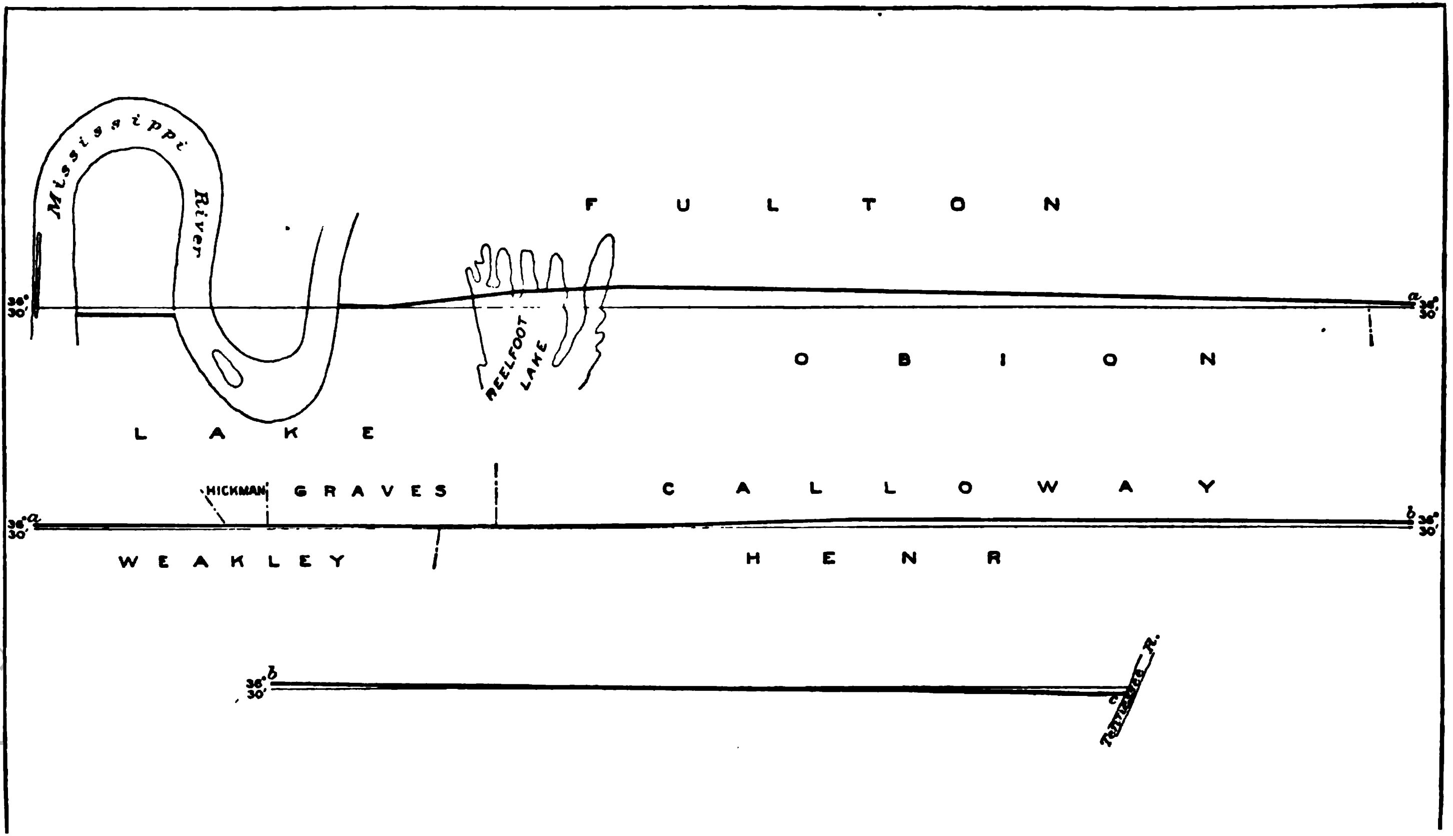
TENNESSEE.

Tennessee was originally a part of North Carolina. (For further information *vide* North Carolina, p. 98.)

In 1790 it was ceded to the United States. Its boundaries described in the act of cession are, substantially, those of the present day.

On June 1, 1796, by an act of Congress it was admitted into the Union.

The act of admission declares its boundaries as "All the territory ceded by North Carolina."


Mississippi River
FULTON
OBION
LAKE
REELFOOT LAKE
HICKMAN
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CALLOWAY
WEAKLEY
HENRY
Tennessee R.
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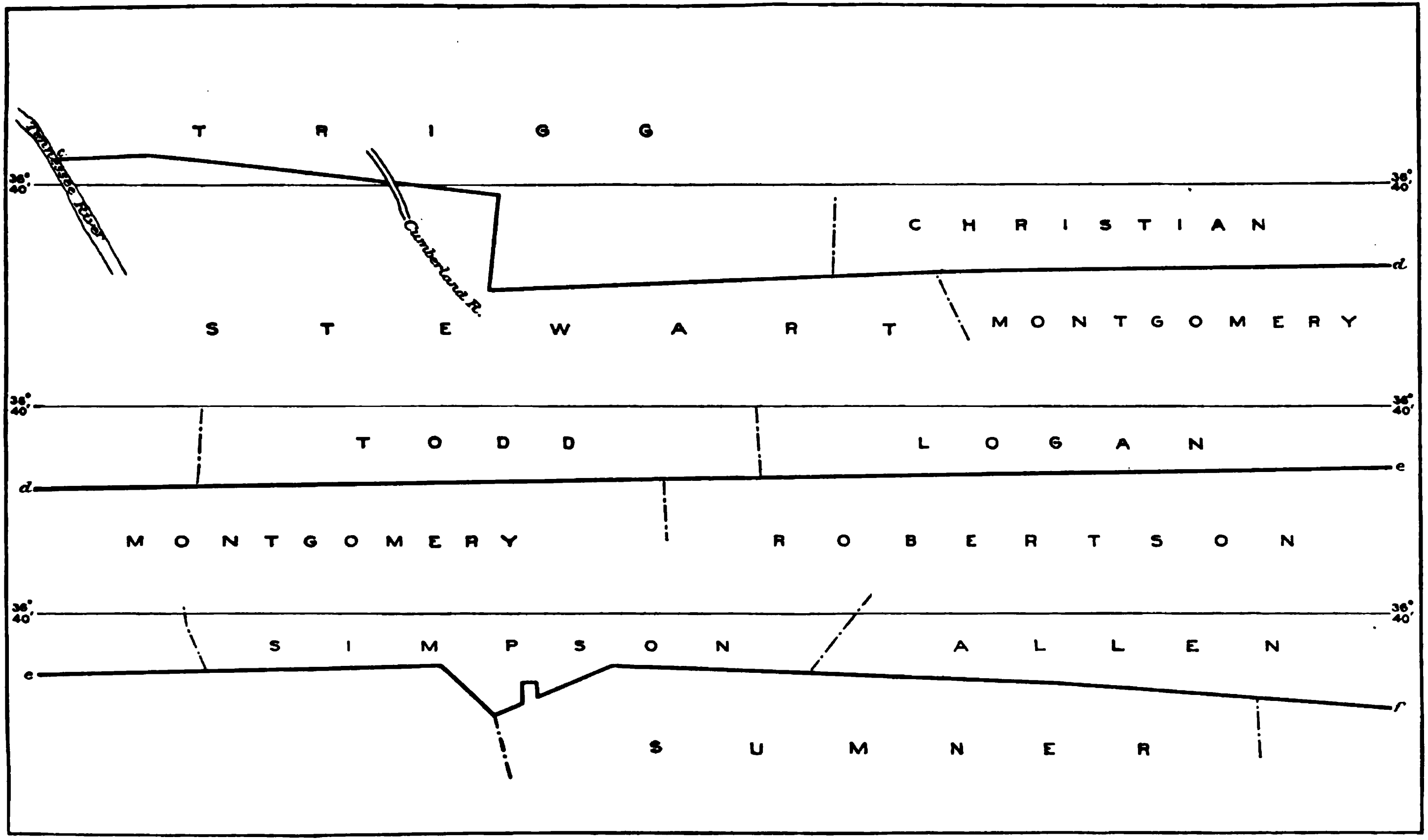
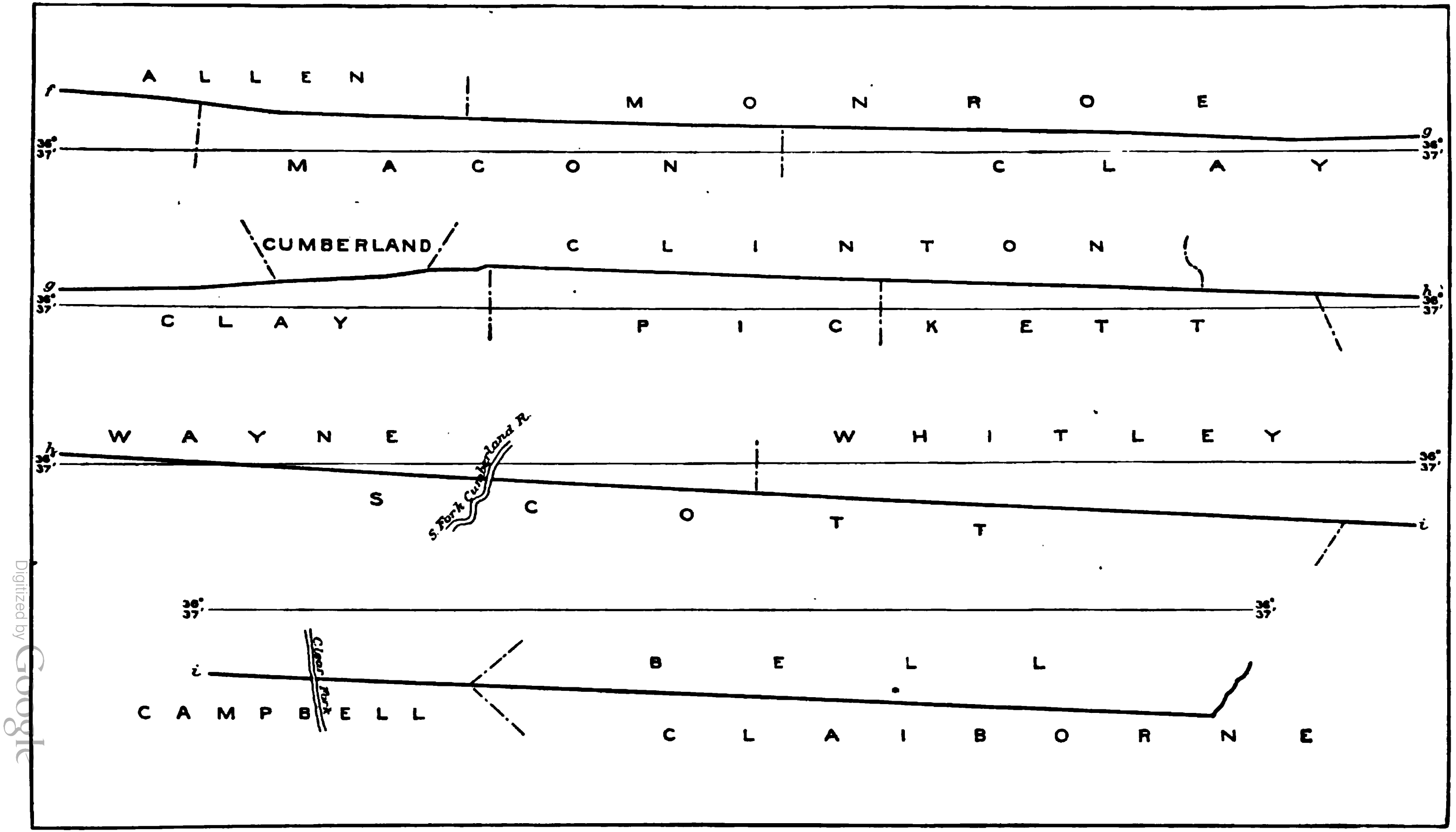


BOUNDARY BETWEEN KENTUCKY AND TENNESSEE.



BOUNDARY BETWEEN KENTUCKY AND TENNESSEE.

(For the history of the eastern boundary, *vide* North Carolina, p. 101; for the southern boundary, *vide* Georgia, p. 105, Alabama, p. 109, and Mississippi, p. 109.)

The Mississippi River forms its western boundary under the treaty of peace of 1783.

The line which divided Virginia and North Carolina was the southern boundary of Kentucky. Virginia and North Carolina, prior to the creation of the States of Kentucky and Tennessee, appointed commissioners, Messrs. Walker and Henderson, to run and mark the line on the parallel of latitude 36° 30′. From a point on the top of the Cumberland Mountains, now the southeastern corner of Kentucky, Walker ran and marked the line to a point on the Tennessee River. This line, called Walker's line, was regarded for many years as the dividing line between Kentucky and Tennessee. It was ascertained, however, that Walker's line was north of latitude 36° 30′.

The Indian title to the land west of the Tennessee River being extinguished by the treaty of 1819, the legislature appointed Robert Alexander and Luke Munsell to ascertain the true point of latitude 36° 30′ on the Mississippi River, and to run and mark a line east on that parallel, which was done as far east as the Tennessee River. (For above, see Gen. Stat. Ky., 1873, p. 167.)

In 1820 commissioners were appointed by Kentucky and Tennessee, respectively, to settle the boundary. Their report was ratified, and is as follows, viz:

> ART. I. The line of boundary and separation between the States of Kentucky and Tennessee shall be as follows, viz:
>
> The line run by the Virginia commissioners in the year 1779–'80, commonly called Walker's line, as the same is reputed, understood, and acted upon by the said States, their respective officers and citizens, from the southeastern corner of Kentucky to the Tennessee River; thence with and up said river to the point where the line of Alexander and Munsell, run by them in the last year under the authority of an act of the legislature of Kentucky entitled "An act to run the boundary line between this State and the State of Tennessee, west of the Tennessee River, approved Feb. 8, 1819," would cross said river, and thence with the said line of Alexander and Munsell, to the termination thereof on the Mississippi River below New Madrid.

Then follow nine other articles.

Article III provides for running and marking the line at any subsequent time. (See General Stat. Kentucky, page 170.)

In 1858–'59 commissioners were appointed by Kentucky and Tennessee to run this line.

The detailed report of the commission on the part of Tennessee can be found in Statutes of Tennessee, 1871, Vol. I, pages 223–243, giving courses, bearings, milestones erected, and a map of the boundary.

The report of this commission on the part of Kentucky was published at Frankfort, by the State Printer, 1860, in a pamphlet of 98 octavo pages, with latitudes and a map of the line, on a scale of 1:108,000.

(For a history of the boundary between Virginia and Tennessee, *vide* Virginia, p. 97.)

KENTUCKY.

Kentucky was included in the original limits of Virginia, and was a part of the county of Augusta. Augusta County was formed in 1738. In 1769 Botetourt County was created from a portion of Augusta County; in 1772, Fincastle from Botetourt; in 1776, Kentucky from Fincastle.

The boundaries of all these counties may be found in Hening's Laws of Virginia, Vols. I to IX.

In 1789 Virginia passed an act giving her consent that the county of Kentucky, within her jurisdiction, should be formed into a new State. Accordingly, June 1, 1792, Kentucky was admitted into the Union, with substantially her present boundaries.

By the cession of 1784, by Virginia to the United States, of the territory northwest of the Ohio River, this river became the northwest boundary of the State of Kentucky.

The western boundary, the Mississippi, was fixed by the treaty of peace in 1783.

(For a history of the boundary between Kentucky and Virginia and West Virginia, *vide* Virginia, p. 96; for the boundary between Kentucky and Tennessee, *vide* Tennessee, p. 115.)

OHIO.

Ohio was the first State formed from the original territory northwest of the river Ohio. It was admitted as a State on November 29, 1802, with limits given in the enabling act as follows:

> Bounded on the east by the Pennsylvania line, on the south by the Ohio River, to the mouth of the Great Miami River, on the west by the line drawn due north from the mouth of the Great Miami aforesaid, and on the north by an east and west line drawn through the southerly extreme of Lake Michigan, running east after intersecting the due-north line aforesaid, from the mouth of the Great Miami until it shall intersect Lake Erie or the territorial line; and thence with the same through Lake Erie to the Pennsylvania line aforesaid: *Provided*, That Congress shall be at liberty at any time hereafter either to attach all the territory lying east of the line to be drawn due north from the mouth of the Miami aforesaid to the territorial line, and north of an east and west line drawn through the southerly extreme of Lake Michigan, running east as aforesaid to Lake Erie, to the aforesaid State, or dispose of it otherwise, in conformity to the fifth article of compact between the original States and the people and States to be formed in the territory northwest of the river Ohio. (Seventh Congress, first session.)

In the constitution of Ohio of 1802, Article VII, the boundaries are defined as follows:

> Bounded on the east by the Pennsylvania line; on the south by the Ohio River, to the mouth of the Great Miami River; on the west by the line drawn due north from the mouth of the Great Miami aforesaid; and on the north by an east and west line drawn through the southerly extreme of Lake Michigan, running east after intersecting the due-north line aforesaid from the mouth of the Great Miami, until it shall intersect Lake Erie or the territorial line; and thence with the same through Lake Erie to the Pennsylvania line aforesaid; provided always, and it is hereby fully understood and declared by this convention, that if the southerly bend or extreme of Lake Michigan should extend so far south that a line drawn due east from it should

not intersect Lake Erie, or if it should intersect the said Lake Erie east of the mouth of the Miami River of the Lake, then, and in that case, with the assent of the Congress of the United States, the northern boundary of this State shall be established by, and extending to, a direct line running from the southern extremity of Lake Michigan to the most northerly cape of the Miami Bay, after intersecting the due-north line from the mouth of the Great Miami River as aforesaid; thence northeast to the territorial line, and by the said territorial line to the Pennsylvania line.

In accordance with the provisions in the enabling act, and in the first constitution of the State, the northern boundary of the State was changed so that, instead of running on a parallel drawn from the southern extremity of Lake Michigan, it followed the arc of a great circle drawn from the southern extremity of Lake Michigan to the most northern cape of Maumee ("Miami") Bay.

Following are the texts of the acts providing for the examination of the northern boundary and making the change in the boundary:

AN ACT to provide for the taking of certain observations preparatory to the adjustment of the northern boundary line of the State of Ohio.

That the President of the United States cause to be ascertained, by accurate observation, the latitude and longitude of the southerly extreme of Lake Michigan; and that he cause to be ascertained, by like observation, the point on the Miami of the Lake which is due east therefrom, and also the latitude and longitude of the most northerly cape of the Miami Bay; also, that he cause to be ascertained, with all practicable accuracy, the latitude and longitude of the most southerly point in the northern boundary line of the United States in Lake Erie, and also the points at which a direct line drawn from the southerly extreme of Lake Michigan to the most southerly point in said northern boundary line of the United States will intersect the Miami River and Bay; and also that he cause to be ascertained, by like observation, the point in the Mississippi which is due west from the southerly extreme of Lake Michigan; and that the said observations be made and the result thereof returned to the proper Department within the current year. (Twenty-second Congress, first session, 1832.)

AN ACT to establish the northern boundary line of the State of Ohio, and to provide for the admission of the State of Michigan into the Union.

The northern boundary line of the State of Ohio shall be established at and shall be a direct line drawn from the southern extremity of Lake Michigan to the most northerly cape of the Maumee (Miami) Bay after that line, so drawn, shall intersect the eastern boundary line of the State of Indiana; and from the said north cape of the said bay northeast to the boundary line between the United States and the province of Upper Canada, in Lake Erie, and thence, with the said last-mentioned line, to its intersection with the western line of the State of Pennsylvania. (Twenty-fourth Congress, first session, 1836.)

The northern boundary was originally surveyed in 1817. The western boundary was surveyed in the same year from old Fort Recovery to the northwestern corner. South of Fort Recovery this boundary was surveyed as the first principal meridian of the General Land Office.

INDIANA.

By the act passed in the year 1800, to take effect on and after the 4th day of July of that year, the Territory Northwest of the River Ohio was divided into two parts, the eastern part to retain the old name, the western part to become the Territory of Indiana.

Under this act the Territory of Indiana was organized. The description of the boundary line between these two Territories is given in the following act establishing them:

That from and after the fourth day of July next all that part of the territory of the United States northwest of the Ohio River, which lies to the westward of a line beginning at the Ohio, opposite to the mouth of Kentucky River, and running thence to Fort Recovery, and thence north until it shall intersect the territorial line between the United States and Canada, shall, for the purpose of temporary government, constitute a separate Territory, and be called Indiana Territory.

SEC. 5. That whenever that part of the territory of the United States which lies to the eastward of a line beginning at the mouth of the Great Miami River, and running thence due north to the territorial line between the United States and Canada, shall be erected into an independent State, and admitted into the Union on an equal footing with the original States, thenceforth said line shall become and remain permanently the boundary line between such State and the Indiana Territory, anything in this act contained to the contrary notwithstanding. (Sixth Congress, first session.)

Ohio was admitted in 1802. Its western boundary, a meridian through the mouth of the Miami River, left a narrow strip of country between Ohio and the Territory of Indiana, which was by a clause in the enabling act of Ohio added to Indiana Territory. The following is the clause in question:

SEC. 3. All that part of the territory of the United States northwest of the river Ohio heretofore included in the eastern division of said Territory, and not included within the boundary herein prescribed for the said State, is hereby attached to and made a part of the Indiana Territory.

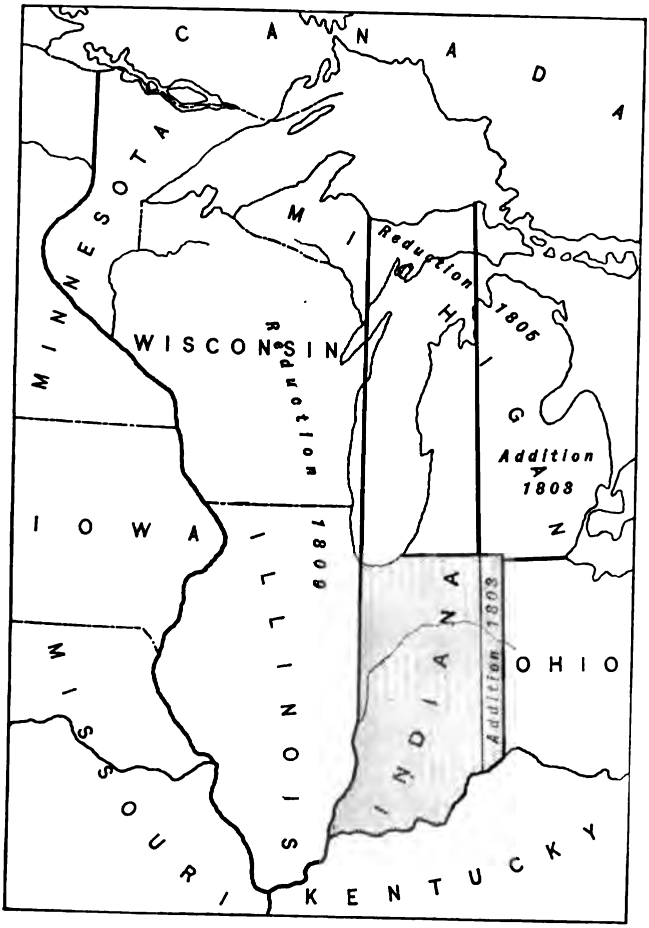
On the 30th of June, 1805, the northern portion of Indiana Territory was cut off and organized as Michigan Territory. (For the divisional line between these, see Michigan, p. 119.)

On March 1, 1809, Indiana Territory was divided, and the western portion of it organized as Illinois Territory. (For a description of the divisional line between these two Territories, see Illinois, p. 119.) On December 11, 1816, Indiana was admitted as a State with the limits as given in the following extract from the enabling act, which have not since been changed.

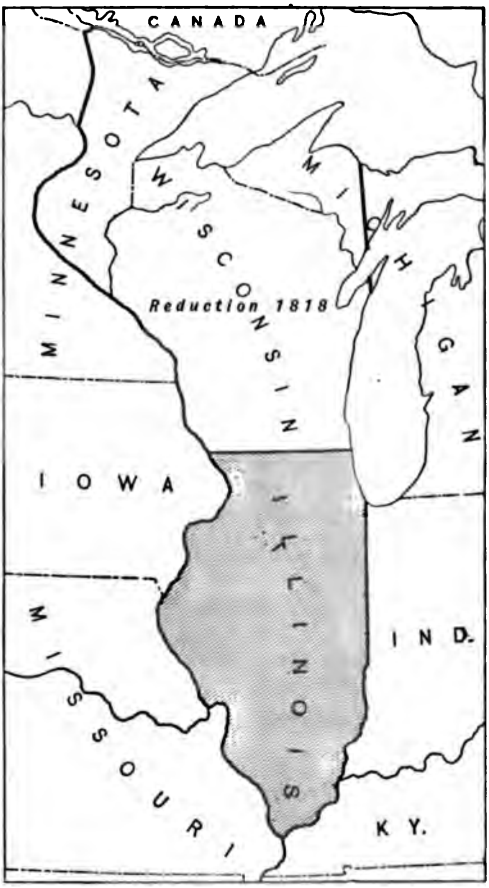
AN ACT to enable the people of the Indiana Territory to form a constitution and State government and for the admission of such State into the Union on an equal footing with the original States.

The said State shall consist of all the territory included within the following boundaries, to wit: Bounded on the east by the meridian line which forms the western boundary of the State of Ohio; on the south by the river Ohio from the mouth of the Great Miami River to the mouth of the River Wabash; on the west by a line drawn along the middle of the Wabash from its mouth to a point where a due north line drawn from the town of Vincennes would last touch the northwestern shore of the said river; and from thence by a due north line, until the same shall intersect an east and west line drawn through a point 10 miles north of the southern extreme of Lake Michigan; on the north by the said east and west line until the same shall intersect the first-mentioned meridian line which forms the western boundary of the State of Ohio. (Fourteenth Congress, first session.)

The north boundary of Indiana was surveyed and marked in 1827, and its west boundary by a joint commission of the two States, Indiana and Illinois.



HISTORICAL DIAGRAM OF INDIANA.



HISTORICAL DIAGRAM OF ILLINOIS.

ILLINOIS.

Illinois Territory, originally part of the Northwest Territory, and subsequently a part of Indiana Territory, was organized on March 1, 1809. The following clause from the act separating it from Indiana Territory defines its boundary:

AN ACT for dividing the Indiana Territory into two separate governments.

From and after the first day of March next, all that part of the Indiana Territory which lies west of the Wabash River and a direct line drawn from the said Wabash River and Post Vincennes due north to the territory line between the United States and Canada shall, for the purpose of temporary government, constitute a separate Territory and be called Illinois. (Tenth Congress, second session.)

On December 3, 1818, it was admitted as a State, with its present boundaries. The enabling act defines these boundaries as follows:

AN ACT to enable the people of the Illinois Territory to form a constitution and State government, and for the admission of such State into the Union on an equal footing with the original States.

The said State shall consist of all the territory included within the following boundaries, to wit: Beginning at the mouth of the Wabash River; thence up the same and with the line of Indiana to the northwest corner of said State; thence east with the line of the same State to the middle of Lake Michigan; thence north along the middle of said lake to north latitude forty-two degrees thirty minutes; thence west to the middle of the Mississippi River; and thence down along the middle of that river to its confluence with the Ohio River; and thence up the latter river along its northwestern shore to the beginning. (Fifteenth Congress, second session.)

The northern boundary of Illinois was run and marked in 1832–33.

MICHIGAN.

Michigan was organized as a Territory June 30, 1805, from the northern part of Indiana Territory.

The following clause from the act dividing Indiana Territory defines its limits:

From and after the thirtieth day of June next all that part of the Indiana Territory which lies north of a line drawn east from the southerly bend or extreme of Lake Michigan, until it shall intersect Lake Erie, and east of a line drawn from the said southerly bend through the middle of said lake to its northern extremity, and thence due north to the northern boundary of the United States, shall, for the purpose of temporary government, constitute a separate Territory, and be called Michigan. (Eighth Congress, second session.)

This line was run and marked in 1827.

The enabling act for Illinois, passed in 1818, contained a provision transferring to the Territory of Michigan the portion of the Territory of Illinois not included in the State of that name. The following is the text of the clause referred to:

All that part of the territory of the United States lying north of the State of Indiana, and which was included in the former Indiana Territory, together with that part of the Illinois Territory which is situated north of and not included within the boundaries prescribed by this act, to the State thereby authorized to be formed, shall be, and hereby is, attached to and made a part of the Michigan Territory, from and after the formation of the said State.

In 1834 an act was passed extending the limits of the Territory of Michigan to the Missouri River.

The clause of this act relating to area is as follows:

AN ACT to attach the territory of the United States west of the Mississippi River and north of the State of Missouri to the Territory of Michigan.

All that part of the territory of the United States bounded on the east by the Mississippi River, on the south by the State of Missouri and a line drawn due west from the northwest corner of said State to the Missouri River; on the southwest and west by the Missouri River and the White Earth River, falling into the same; and on the north by the northern boundary of the United States, shall be, and hereby is, for the purpose of temporary government, attached to and made a part of the Territory of Michigan.

In 1836 Wisconsin Territory was formed from that part of Michigan Territory lying west of the present limits of the State of that name. (*Vide* Wisconsin, p. 121.)

The boundary line between Michigan and Wisconsin, between the sources of Brule and Montreal rivers, was run and marked in 1847.

Reduced to its present limits, as described in the following clause from its enabling act, Michigan was admitted to the Union January 26, 1837:

AN ACT to provide for the admission of the State of Michigan into the Union.

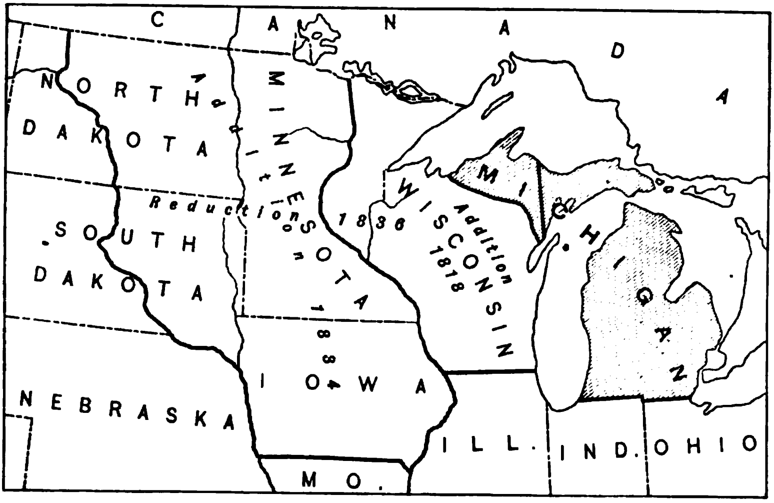
Beginning at the point where the above-described northern boundary of the State of Ohio intersects the eastern boundary of the State of Indiana, and running thence with the said boundary line of Ohio, as described in the first section of this act, until it intersects the boundary line between the United States and Canada in Lake Erie; thence with the said boundary line between the United States and Canada, through the Detroit River, Lake Huron, and Lake Superior, to a point where the said line last touches Lake Superior; thence in a direct line through Lake Superior to the mouth of the Montreal River; thence through the middle of the main channel of the said river Montreal to the middle of the Lake of the Desert; thence in a direct line to the nearest headwater of the Menomonee River; thence through the middle of that fork of the said river first touched by the said line to the main channel of the said Menomonee River; thence down the center of the main channel of the same to the center of the most usual ship channel of the Green Bay of Lake Michigan; thence through the center of the most usual ship channel of the said bay to the middle of Lake Michigan; thence through the middle of Lake Michigan to the northern boundary of the State of Indiana, as that line was established by the act of Congress of the nineteenth of April, eighteen hundred and sixteen; thence due east with the north boundary line of the said State of Indiana to the northeast corner thereof; and thence south with the east boundary line of Indiana to the place of beginning. (Twenty-fourth Congress, first session.)

The above boundaries remain unchanged.

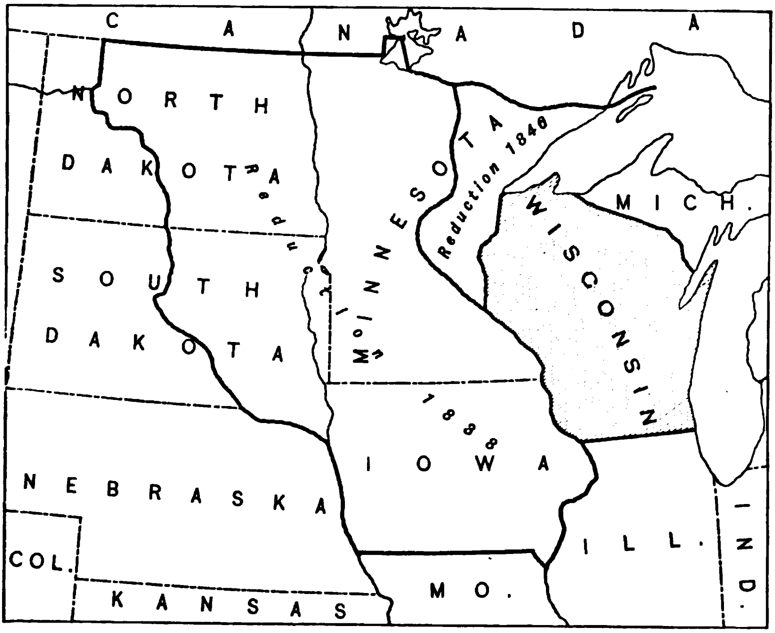
WISCONSIN.

Wisconsin was organized as a Territory July 3, 1836. As originally constituted its area comprised all that part of the former Territory of Michigan which lay outside of the present limits of the State of Michigan. The limits are defined in the act for its organization as follows:

Bounded on the east by a line drawn from the northeast corner of the State of Illinois, through the middle of Lake Michigan, to a point in the middle of said lake and opposite the main channel of Green Bay, and through said channel and Green Bay to



HISTORICAL DIAGRAM OF MICHIGAN.



HISTORICAL DIAGRAM OF WISCONSIN.

the mouth of the Menomonee; thence through the middle of the main channel of said river to that head of said river nearest to the Lake of the Desert; thence in a direct line to the middle of said lake; thence through the middle of the main channel of the Montreal River to its mouth; thence with a direct line across Lake Superior to where the territorial line of the United States last touches said lake northwest; thence on the north with the said territorial line to the White Earth River, on the west by a line from the said boundary line following down the middle of the main channel of White Earth River to the Missouri River, and down the middle of the main channel of the Missouri River to a point due west from the northwest corner of the State of Missouri, and on the south from said point due east to the northwest corner of the State of Missouri; and thence with the boundaries of the States of Missouri and Illinois as already fixed by acts of Congress. (Twenty-fourth Congress, first session.)

In 1838 all that part of the territory lying west of the Mississippi and a line drawn due north from its source to the international boundary—that is, all that part which was originally comprised in the Louisiana purchase—was organized as the Territory of Iowa. (See Iowa, p. 123.)

On August 9, 1846, an enabling act for Wisconsin was passed giving the boundaries as follows:

Beginning at the northeast corner of the State of Illinois, that is to say, at a point in the center of Lake Michigan where the line of forty-two degrees and thirty minutes of north latitude crosses the same; thence running with the boundary line of the State of Michigan, through Lake Michigan, Green Bay, to the mouth of the Menomonee River; thence up the channel of said river to the Brule River; thence up said last-mentioned river to Lake Brule; thence along the southern shore of Lake Brule in a direct line to the center of the channel between Middle and South islands in the Lake of the Desert; thence in a direct line to the headwaters of Montreal River, as marked upon the survey made by Captain Cramm; thence down the main channel of the Montreal River to the middle of Lake Superior; thence through the center of Lake Superior to the mouth of the Saint Louis River; thence up the main channel of said river to the first rapids in the same, above the Indian village, according to Nicollet's map; thence due south to the main branch of the river Saint Croix; thence down the middle of the main channel of said river to the Mississippi; thence down the center of the main channel of that river to the northwest corner of the State of Illinois; thence due east with the northern boundary of the State of Illinois to the place of beginning. (Twenty-ninth Congress, first session.)

On March 3, 1847, a supplementary act for the admission of Wisconsin was passed by Congress, in which the western boundary of the proposed State was changed as follows:

That the assent of Congress is hereby given to the change of boundary proposed in the first article of said constitution, to wit: Leaving the boundary line prescribed in the act of Congress entitled "An act to enable the people of Wisconsin Territory to form a constitution and State government, and for the admission of such State into the Union," at the first rapids in the river St. Louis; thence in a direct line southwardly to a point fifteen miles east of the most easterly point of Lake St. Croix; thence due south to the main channel of the Mississippi River or Lake Pepin; thence down the said main channel, as prescribed in said act. (Twenty-ninth Congress, second section.)

On May 29, 1848, Wisconsin was admitted into the Union.

The boundary between this State and Minnesota from St. Louis to St. Croix River was surveyed and marked in 1852, under the General Land Office.

MISSOURI.

The name of the Territory of Louisiana was changed in 1812 to Missouri, by act of Congress. At that time the Territory comprised all of the original Louisiana purchase, excepting the State of Louisiana, which had been formed from it. The Territory of Arkansas, with limits very similar to those of the present State, was formed from it in 1819. On August 10, 1821, the *State* of Missouri was formed and admitted, with limits, excepting as to the northwest corner, the same as at present.

Boundaries are defined as follows:

Beginning in the middle of the Mississippi River, on the parallel of thirty-six degrees of north latitude; thence west along that parallel of latitude to the Saint Francois River; thence up and following the course of that river, in the middle of the main channel thereof, to the parallel of latitude of thirty-six degrees and thirty minutes; thence west along the same to a point where the said parallel is intersected by a meridian line passing through the middle of the mouth of the Kansas River where the same empties into the Missouri River; thence from the point aforesaid north along the said meridian line to the intersection of the parallel of latitude which passes through the rapids of the river Des Moines, making the said line to correspond with the Indian boundary line; thence east from the point of intersection last aforesaid along the said parallel of latitude to the middle of the channel of the main fork of the said river Des Moines; thence down and along the middle of the main channel of the said river Des Moines to the mouth of the same where it empties into the Mississippi River; thence due east to the middle of the main channel of the Mississippi River; thence down and following the course of the Mississippi River, in the middle of the main channel thereof, to the place of beginning. (Sixteenth Congress, first session.)

In 1836 the boundaries were extended on the northwest to the Missouri River, as described in the following act of the legislature amendatory to the constitution of 1820:

That the boundary of the State be so altered and extended as to include all that tract of land lying on the north side of the Missouri River and west of the present boundary of this State, so that the same shall be bounded on the south by the middle of the main channel of the Missouri River and on the north by the present northern boundary line of the State, as established by the constitution, when the same is continued in a right line to the west, or to include so much of said tract of land as Congress may assent.

This was ratified by Congress in the following act:

AN ACT to extend the western boundary of the State of Missouri to the Missouri River.

That when the Indian title to all the lands lying between the State of Missouri and the Missouri River shall be extinguished, the jurisdiction over said lands shall be hereby ceded to the State of Missouri, and the western boundary of said State shall be then extended to the Missouri River. (Twenty-fourth Congress, first session.)

The north boundary of Missouri was surveyed and marked in part in 1816, and the remainder in 1850, under the General Land Office.

The western boundary was run and marked, from the mouth of Kansas River to the southwestern corner of the State, in 1823.

The territory remaining after the formation of the State bore the name of Missouri for many years thereafter. Meanwhile, however, it

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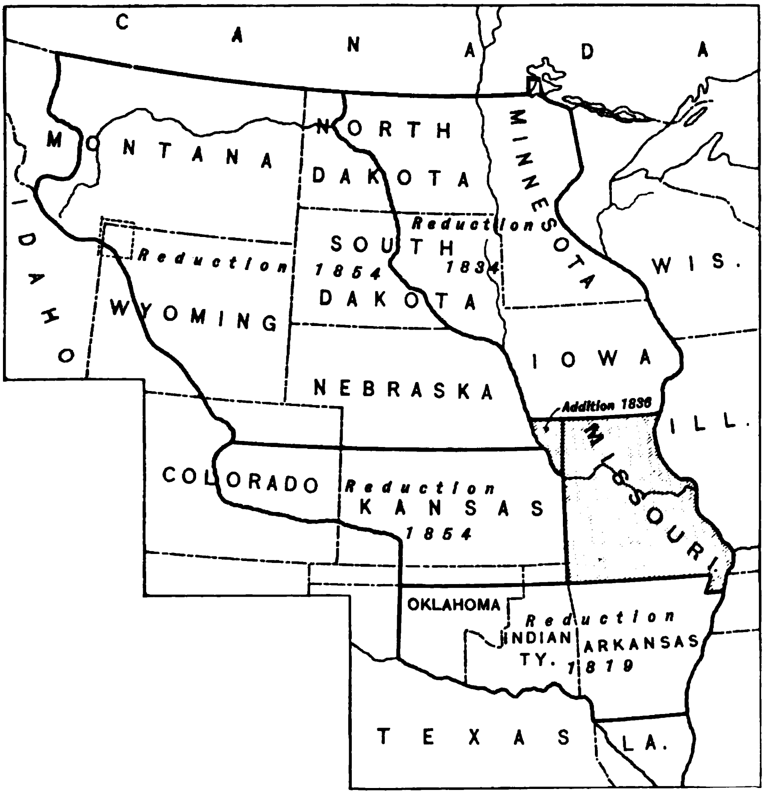


HISTORICAL DIAGRAM OF MISSOURI.

was reduced by the formation of several Territories which were carved from its area. In 1834 the part north of the State of Missouri and east of Missouri and White Earth rivers was annexed to the Territory of Michigan. (For further history of this portion, *vide* Michigan, p. 119; Iowa, below; Minnesota, p. 124; and Dakota, p. 127.) In 1854 Kansas and Nebraska Territories were formed, absorbing the remainder. (*Vide* Kansas, p. 125, and Nebraska, p. 126.)

The following are the boundaries of Missouri as at present established: The east boundary is the mid-channel of the Mississippi River from the mouth of the Des Moines to its point of intersection with the thirty-sixth parallel of latitude; the south boundary begins at the latter point and runs west on the parallel of 36 degrees of latitude to the Saint Francis River, thence up the mid-channel of that river to the parallel of latitude 39° 30′, thence west on that parallel to its intersection by a meridian passing through the middle of the mouth of the Kansas River; the west boundary is the last-mentioned meridian as far north as the mouth of the Kansas River, thence it follows northwestward the mid-channel of the Missouri River to the parallel of latitude passing through the rapids of Des Moines River, which is approximately the parallel of 40° 35′; the north boundary is the last-mentioned parallel as far east as its point of intersection with the Des Moines River, whence it follows the mid-channel of the Des Moines River southward to its mouth.

IOWA.

Iowa was organized as a Territory on July 3, 1838, being formed from a portion of Wisconsin Territory. The limits were defined as follows in the act creating it:

> All that part of the present Territory of Wisconsin which lies west of the Mississippi River and west of the line drawn due north from the headwaters or sources of the Mississippi to the Territorial line. (Twenty-fifth Congress, second session. See Wisconsin, p. 115.)

The following clause from an act passed in 1839 is supplementary to the above act:

> AN ACT to define and establish the eastern boundary line of the Territory of Iowa.
>
> That the middle or centre of the main channel of the river Mississippi shall be deemed, and is hereby declared, to be the eastern boundary line of the Territory of Iowa, so far or to such extent as the said Territory is bounded eastwardly by or upon said river. (Twenty-fifth Congress, third session.)

Iowa was admitted to the Union on March 3, 1845. As originally constituted the limits of the State were quite different from those which it has at present.

The following extract from the enabling act gives the original limits:

> That the following shall be the boundaries of the said State of Iowa, to wit: Beginning at the mouth of the Des Moines River at the middle of the Mississippi; thence by the middle of the channel of that river to a parallel of latitude passing through the mouth of the Mankato, or Blue Earth River; thence west along the

said parallel of latitude to a point where it is intersected by a meridian line, seventeen degrees and thirty minutes west of the meridian of Washington City; thence due south to the northern boundary line of the State of Missouri; thence eastwardly following that boundary to the point at which the same intersects the Des Moines River; thence by the middle of the channel of that river to the place of beginning. (Twenty-eighth Congress, second session.)

On December 28, 1846, an act was passed changing the boundaries of the State and giving it its present limits.

The following extract from the act defines the boundaries as at present constituted:

> Beginning in the middle of the main channel of the Mississippi River, at a point due east of the middle of the mouth of the main channel of the Des Moines River; thence up the middle of the main channel of the said Des Moines River to a point on said river where the northern boundary line of the State of Missouri, as established by the constitution of that State, adopted June twelfth, eighteen hundred and twenty, crosses the said middle of the main channel of the said Des Moines River; thence westwardly along the said northern boundary line of the State of Missouri, as established at the time aforesaid, until an extension of said line intersect the middle of the main channel of the Missouri River, to a point opposite the middle of the main channel of the Big Sioux River, according to Nicollet's map; thence up the main channel of the said Big Sioux River, according to said map, until it is intersected by the parallel of forty-three degrees and thirty minutes north latitude; thence east along said parallel of forty-three degrees and thirty minutes, until said parallel intersect the middle of the main channel of the Mississippi River; thence down the middle of the main channel of said Mississippi River to the place of beginning.

Its northern boundary was surveyed and marked in 1852, under the General Land Office.

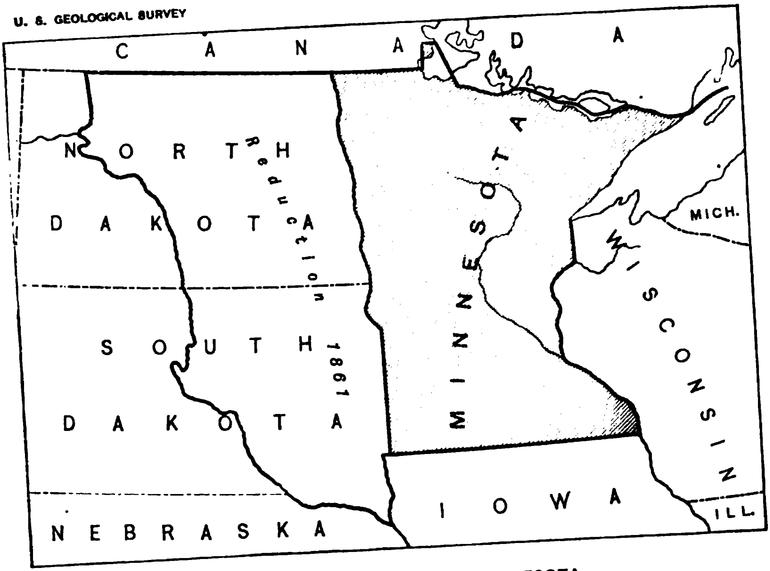
MINNESOTA.

The Territory of Minnesota was organized on March 3, 1849, and originally comprised the portion of the former Territory of Iowa, outside of the limits of the present State of Iowa, extending east to the west boundary line of Wisconsin. The terms of the act creating this Territory, so far as they relate to its boundary, are as follows:

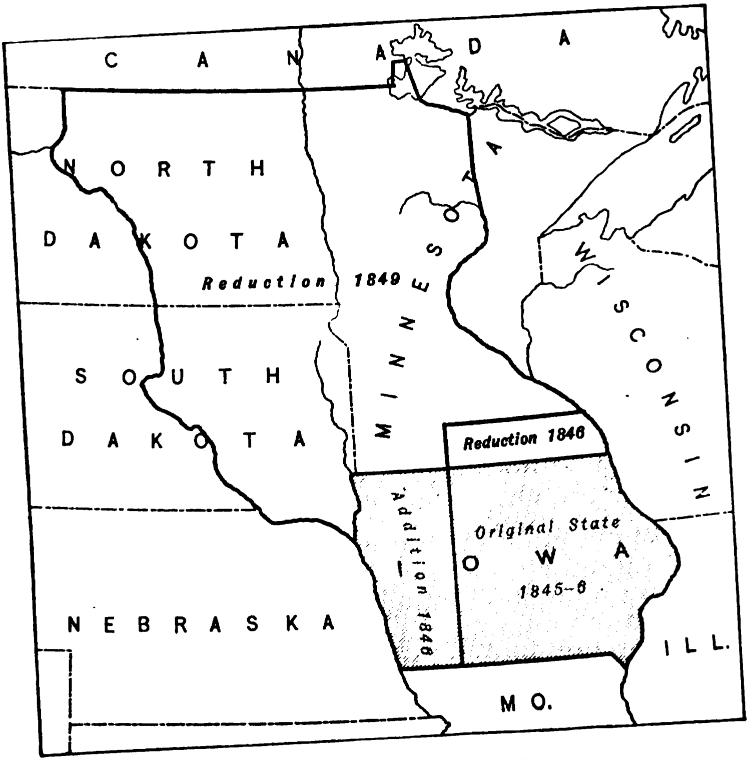
> All that part of the territory of the United States which lies within the following limits, to wit: Beginning in the Mississippi River, at the point where the line of forty-three degrees and thirty minutes of north latitude crosses the same; thence running due west on said line, which is the northern boundary of the State of Iowa, to the northwest corner of the said State of Iowa; thence southerly along the western boundary of said State to the point where said boundary strikes the Missouri River; thence up the middle of the main channel of the Missouri River to the mouth of the White Earth River; thence up the middle of the main channel of the White Earth River to the boundary line between the possessions of the United States and Great Britain to Lake Superior; thence along the western boundary line of said State of Wisconsin to the Mississippi River; thence down the main channel of said river to the place of beginning. (Thirtieth Congress, second session.)

Minnesota was admitted as a State on May 11, 1858, with the same boundaries which it has at present. These are given in the enabling act as follows:

> Beginning at the point in the center of the main channel of the Red River of the North where the boundary line between the United States and the British Possessions



HISTORICAL DIAGRAM OF MINNESOTA.



HISTORICAL DIAGRAM OF IOWA.

crosses the same; thence up the main channel of said river to that of the Bois des Sioux River; thence up the main channel of said river to Lake Traverse; thence up the center of said lake to the southern extremity thereof; thence in a direct line to the head of Big Stone Lake; thence through its center to its outlet; thence by a due south line to the north line of the State of Iowa; thence east along the northern boundary of said State to the main channel of the Mississippi River; thence up the main channel of said river, and following the boundary line of the State of Wisconsin until the same intersects the Saint Louis River; thence down said river to and through Lake Superior, on the boundary line of Wisconsin and Michigan, until it intersects the dividing line between the United States and the British Possessions; thence up Pigeon River, and following said dividing line, to the place of beginning.

The western boundary line, from Big Sioux River to Minnesota River, was surveyed and marked in 1859–60, under the General Land Office.

KANSAS.

The Territory of Kansas was organized on May 30, 1854, from a part of Missouri Territory. The following clause from the act of organization defines its limits:

SECTION 19. All that part of the territory of the United States included within the following limits, except such portions thereof as are hereinafter expressly exempted from the operations of this act, to wit: Beginning at a point on the western boundary of the State of Missouri, where the thirty-seventh parallel of north latitude crosses the same; thence west on said parallel to the eastern boundary of New Mexico; thence north on said boundary to latitude thirty-eight; thence following said boundary westward to the east boundary of the Territory of Utah, on the summit of the Rocky Mountains; thence northward on said summit to the fortieth parallel of latitude; thence east on said parallel to the western boundary of the State of Missouri; thence south with the western boundary of said State to the place of beginning, be, and the same is hereby, created into a temporary government by the name of the Territory of Kansas.

A portion of this Territory was given up to Colorado at the time of its formation in 1861. (*Vide* Colorado, p. 130.)

Kansas was admitted into the Union on January 29, 1861, with its present boundaries, which are thus defined in the enabling act:

The said State shall consist of all the territory included within the following boundaries, to wit: Beginning at a point on the western boundary of the State of Missouri where the thirty-seventh parallel of north latitude crosses the same; thence west on said parallel to the twenty-fifth meridian of longitude west from Washington; thence north on said meridian to the fortieth parallel of latitude; thence east on said parallel to the western boundary of the State of Missouri; thence south with the western boundary of said State to the place of beginning.

The south boundary was surveyed and marked by Col. J. E. Johnston, in 1857. This line was subsequently retraced and re-marked by deputy surveyors, in the extension of the public land surveys. The western boundary was surveyed in 1872, under the General Land Office.

The north boundary, which is the base line for the sixth principal meridian, was run by deputy surveyors of the General Land Office, 1855–59, the initial point, on the Missouri river, having been determined by Capt. Lee, U. S. topographical engineer.

NEBRASKA.

The Territory of Nebraska was formed on May 30, 1854, from the northwestern part of Missouri Territory. Its limits, as originally constituted, are defined as follows in the act of organization:

> Beginning at a point in the Missouri River where the fortieth parallel of north latitude crosses the same; thence west on said parallel to the east boundary of the Territory of Utah, on the summit of the Rocky Mountains; thence on said summit northward to the forty-ninth parallel of north latitude; thence east on said parallel to the western boundary of the Territory of Minnesota; thence southward on said boundary to the Missouri River; thence down the main channel of said river to the place of beginning, be, and the same is hereby, created into a temporary government by the name of the Territory of Nebraska. (Thirty-third Congress, first session.)

This area was reduced in 1861 by the formation of the Territories of Colorado and Dakota. (*Vide* Colorado, p. 130, and Dakota, p. 127.)

The State of Nebraska was admitted on March 1, 1867.

Its limits are defined as follows in the enabling act:

> That the said State of Nebraska shall consist of all the territory included within the following boundaries, to wit: Commencing at a point formed by the intersection of the western boundary of the State of Missouri with the fortieth degree of north latitude; extending thence due west along said fortieth degree of north latitude to a point formed by its intersection with the twenty-fifth degree of longitude west from Washington; thence north along said twenty-fifth degree of longitude to a point formed by its intersection with the forty-first degree of north latitude; thence west along said forty-first degree of north latitude to a point formed by its intersection with the twenty-seventh degree of longitude west from Washington; thence north along said twenty-seventh degree of west longitude to a point formed by its intersection with the forty-third degree of north latitude; thence east along said forty-third degree of north latitude to the Keyapaha River; thence down the middle of the channel of said river, with its meanderings, to its junction with the Niobrara River; thence down the middle of the channel of said Niobrara River, and following the meanderings thereof, to its junction with the Missouri River; thence down the middle of the channel of said Missouri River, and following the meanderings thereof, to the place of beginning. (Thirty-eighth Congress, first session.)

In 1870 an act was passed to redefine a portion of the boundary between Nebraska and the Territory of Dakota, the pertinent portion of which is as follows:

> That so soon as the State of Nebraska, through her legislature, has given her consent thereto, the center of the main channel of the Missouri River shall be the boundary line between the State of Nebraska and Territory of Dakota, between the following points, to wit: Commencing at a point in the center of said main channel, north of the west line of section twenty-four in township twenty-nine north, of range eight east of the sixth principal meridian, and running along the same to a point west of the most northerly portion of fractional section seventeen, of township twenty-nine north, of range nine east of said meridian, in the State of Nebraska, as meandered and shown by the plats and surveys of said sections originally made and now on file in the General Land Office. (Forty-first Congress, second session.)

The west boundary on the twenty-fifth degree of longitude west of Washington, between latitudes 40° and 41°, the south boundary on the forty-first parallel from the twenty-fifth degree of longitude to the

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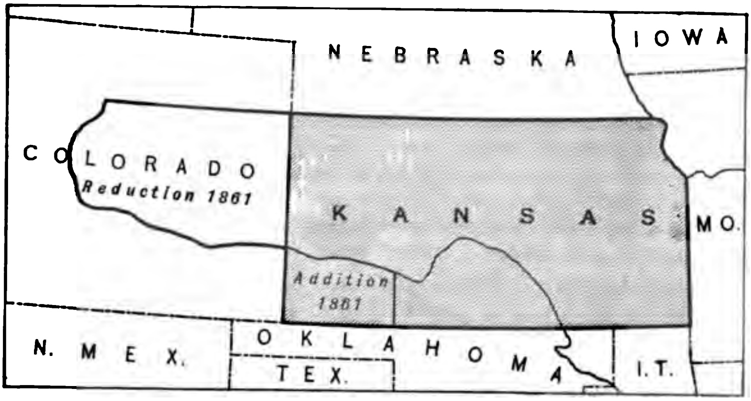
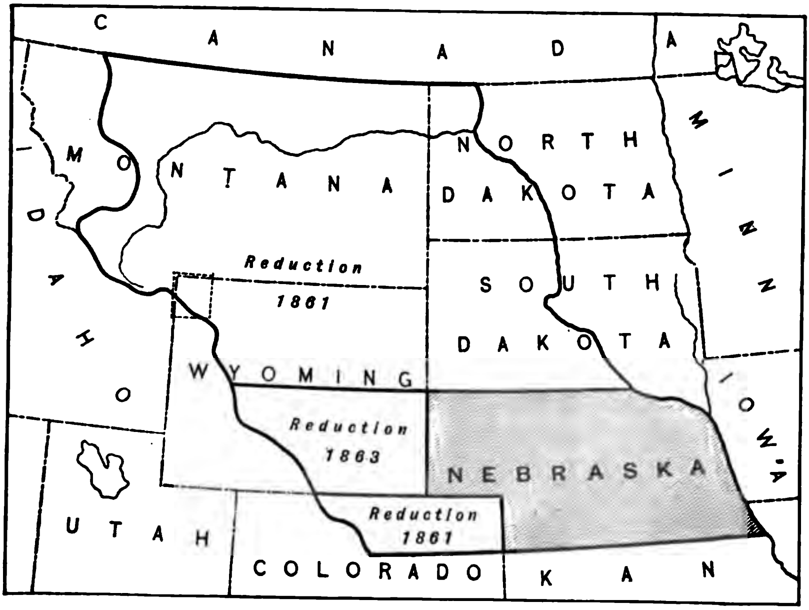


HISTORICAL DIAGRAM OF KANSAS.



HISTORICAL DIAGRAM OF NEBRASKA.

twenty-seventh degree, and the west boundary on the twenty-seventh degree of longitude, between the forty-first degree and the forty-third degree, were surveyed and marked in 1869, under the General Land Office.

In 1882 an act was passed transferring to this State from Dakota a small area lying between the Keyapaha River and the forty-third parallel of latitude. The following is the act in question:

> *Be it enacted,* * * * That the northern boundary of the State of Nebraska shall be, and hereby is, subject to the provisions hereinafter contained, extended so as to include all that portion of the Territory of Dakota lying south of the forty-third parallel of north latitude and east of the Keyapaha River and west of the main channel of the Missouri River. (Forty-seventh Congress, first session.)

The north boundary, from the Keyapaha River westward, was surveyed in 1873. In 1893 the part of this boundary east of Keyapaha River was surveyed and the remainder resurveyed. All this was done under the General Land Office.

NORTH DAKOTA AND SOUTH DAKOTA.

The Territory of Dakota was organized on March 2, 1861, from parts of Minnesota and Nebraska Territories. The following from the act of organization defines its original limits:

> All that part of the territory of the United States included within the following limits, namely: Commencing at a point in the main channel of the Red River of the North where the forty-ninth degree of north latitude crosses the same; thence up the main channel of the same and along the boundary of the State of Minnesota to Big Stone Lake; thence along the boundary line of the said State of Minnesota to the Iowa line; thence along the boundary line of the State of Iowa to the point of intersection between the Big Sioux and Missouri rivers; thence up the Missouri River and along the boundary line of the Territory of Nebraska to the mouth of the Niobrara or Running Water River; thence following up the same, in the middle of the main channel thereof, to the mouth of the Keyapaha or Turtle Hill River; thence up said river to the forty-third parallel of north latitude; thence due west to the present boundary of the Territory of Washington; thence along the boundary line of Washington Territory to the forty-ninth degree of north latitude; thence east along said forty-ninth degree of north latitude to the place of beginning, be, and the same is hereby, organized into a temporary government by the name of the Territory of Dakota. (Thirty-sixth Congress, second session.)

In 1863 the Territory of Idaho was formed, its area having been taken from Washington, Dakota, and Nebraska. (*Vide* Idaho, p. 134.) In 1882 a small area was transferred to Nebraska. (*Vide* Nebraska, above.)

In 1877 that part of the west boundary between latitudes 43° and 45° was surveyed and marked, under the General Land Office.

On November 2, 1889, the Territory of Dakota was divided into North and South Dakota, and each was admitted as a State. The following extract from the enabling act defines the boundary between these States:

> The area comprising the Territory of Dakota shall * * * be divided on the line of the seventh standard parallel produced due west to the western boundary of said Territory.

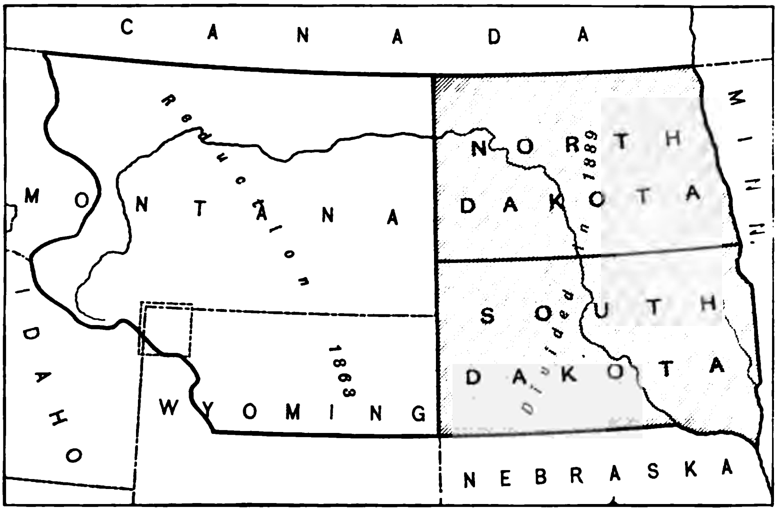
The boundary line between the two States was surveyed in 1891-92, under the General Land Office.

OKLAHOMA.

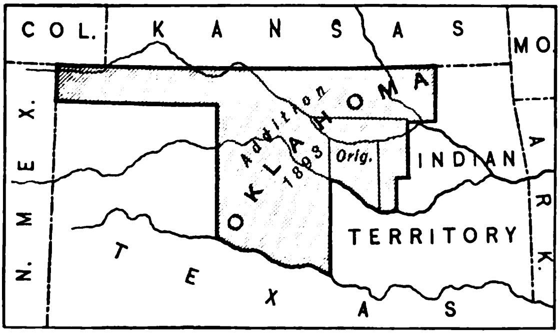
The Territory of Oklahoma was organized under an act passed May 2, 1890, from the western part of the Indian Territory. Its limits as originally constituted were as is set forth in the following act:

Be it enacted by the Senate and House of Representatives of the United States of America in Congress assembled, SEC. 1. That all that portion of the United States now known as the Indian Territory, except so much of the same as is actually occupied by the Five Civilized Tribes, and the Indian tribes within the Quapaw Indian Agency, and except the unoccupied part of the Cherokee Outlet, together with that portion of the United States known as the Public Land Strip, is hereby erected into a temporary government by the name of the Territory of Oklahoma. The portion of the Indian Territory included in said Territory of Oklahoma is bounded by a line drawn as follows: Commencing at a point where the ninety-eighth meridian crosses the Red River; thence by said meridian to the point where it crosses the Canadian River; thence along said river to the west line of the Seminole country; thence along said line to the north fork of the Canadian River; thence down said river to the west line of the Creek country; thence along said line to the northwest corner of the Creek country; thence along the north line of the Creek country to the ninety-sixth meridian; thence northward by said meridian to the southern boundary line of Kansas; thence west along said line to the Arkansas River; thence down said river to the north line of the land occupied by the Ponca tribe of Indians, from which point the line runs so as to include all the lands occupied by the Ponca, Tonkawa, Otoe and Missouria, and the Pawnee tribes of Indians until it strikes the south line of the Cherokee Outlet, which it follows westward to the east line of the State of Texas; thence by the boundary line of the State of Texas to the point of beginning. The Public Land Strip which is included in said Territory of Oklahoma is bounded east by the one hundredth meridian, south by Texas, west by New Mexico, north by Colorado and Kansas. Whenever the interest of the Cherokee Indians in the land known as the Cherokee Outlet shall have been extinguished and the President shall make proclamation thereof, said outlet shall thereupon and without further legislation become a part of the Territory of Oklahoma. Any other lands within the Indian Territory not embraced within these boundaries shall hereafter become a part of the Territory of Oklahoma whenever the Indian nation or tribe owning such lands shall signify to the President of the United States in legal manner its assent that such lands shall so become a part of said Territory of Oklahoma, and the President shall thereupon make proclamation to that effect.

The lands embraced within the limits above set forth comprised the present Territory of Oklahoma, with the exception of an area on the north known as the Cherokee Strip, and provision was made for its incorporation, without additional legislation, within the Territory whenever the Indian title to it should be extinguished. This was done and the strip was added to the Territory by proclamation of the President, issued in September, 1893, giving Oklahoma its present limits. These differ from those above set forth only in a part of the northern boundary, which now corresponds with the south boundary of Kansas from the ninety-sixth meridian west.



HISTORICAL DIAGRAM OF NORTH DAKOTA AND SOUTH DAKOTA.



HISTORICAL DIAGRAM OF OKLAHOMA.

MONTANA.

The Territory of Montana was organized May 26, 1864, from a portion of Idaho. Its limits, which have been changed but slightly, are given in the following extract from the organizing act:

> That all that part of the territory of the United States included within the limits to wit: Commencing at a point formed by the intersection of the twenty-seventh degree of longitude west from Washington with the forty-fifth degree of north latitude; thence due west on said forty-fifth degree of latitude to a point formed by its intersection with the thirty-fourth degree of longitude west from Washington; thence due south along said thirty-fourth degree of longitude to its intersection with the forty-fourth degree and thirty minutes of north latitude; thence due west along said forty-fourth degree and thirty minutes of north latitude to a point formed by its intersection with the crest of the Rocky Mountains; thence following the crest of the Rocky Mountains northward till its intersection with the Bitter Root Mountains; thence northward along the crest of said Bitter Root Mountains to its intersection with the thirty-ninth degree of longitude west from Washington; thence along said thirty-ninth degree of longitude northward to the boundary line of the British possessions; thence eastward along said boundary line to the twenty-seventh degree of longitude west from Washington; thence southward along said twenty-seventh degree of longitude to the place of beginning, be, and the same is hereby, created into a temporary government by the name of the Territory of Montana. (Thirty-eighth Congress, first session.)

In 1873 Congress, under the erroneous impression that a portion of Dakota remained west of Wyoming, and adjoining Montana, passed an act to attach it to Montana. As, however, no such detached area could by any possibility have existed, the compilers of the Revised Statutes sought to give the act effect by shifting a portion of the southern boundary of Montana from the parallel of 44° 30′ to the continental watershed, thereby reducing Montana's area. The following is the act referred to:

> AN ACT to readjust the western boundary of Dakota Territory.
>
> That all that portion of Dakota Territory lying west of the one hundred and eleventh meridian of longitude which, by an erroneous definition of the boundaries of said Territory by a former act of Congress, remains detached and distant from Dakota proper some two hundred miles, be, and the same is hereby, attached to the adjoining territory of Montana. (Forty-second Congress, third session.)

The boundaries of Montana are as follows: Beginning at the intersection of the twenty-seventh meridian of longitude with the boundary line between the United States and the British possessions, it follows said meridian south to the forty-fifth parallel of latitude, thence west on this parallel to the thirty-fourth meridian, south on the thirty-fourth meridian to the point where that meridian intersects the continental watershed, thence westward and northwestward, following the line of the continental watershed and the summit of the Bitter Root range, to its intersection with the thirty-ninth meridian; thence north on the thirty-ninth meridian to the boundary line between the United States and British possessions and east on that boundary line to the point of beginning.

The east boundary of Montana was surveyed and marked in 1885, and the south boundary in 1879–80, under the General Land Office. That portion of the west boundary between the crest of the Bitterroot Mountains and the Canada line was surveyed and marked in 1898–99, under the United States Geological Survey.

Montana was admitted as a State on November 8, 1889, with the above boundaries.

WYOMING.

Wyoming was organized as a Territory on July 25, 1868, from an area previously comprised in the Territory of Idaho. Its limits, which are the same as originally constituted, are defined in the following clause from the act creating the Territory:

> That all that part of the United States described as follows: Commencing at the intersection of the twenty-seventh meridian of longitude west from Washington with the forty-fifth degree of north latitude, and running thence west to the thirty-fourth meridian of west longitude, thence south to the forty-first degree of north latitude, thence east to the twenty-seventh meridian of west longitude, and thence north to the place of beginning, be, and the same is hereby, organized into a temporary government by the name of the Territory of Wyoming. (Fortieth Congress, second session.)

Wyoming was admitted as a State on July 10, 1890, with the above boundaries.

The south and west boundaries were surveyed and marked in 1873, under the General Land Office.

COLORADO.

Colorado was organized as a Territory on February 28, 1861, with the limits which it has at present, being made from portions of Utah, New Mexico, Kansas, and Nebraska.

On August 1, 1876, it was admitted as a State.

The following clause from the enabling act gives its limits:

> AN ACT to enable the people of Colorado to form a constitution and State government, and for the admission of such State into the Union on an equal footing with the original States.
>
> SEC. 2. That the said State of Colorado shall consist of all the territory included within the following boundaries, to-wit: Commencing at a point formed by the intersection of the thirty-seventh degree of north latitude with the twenty-fifth degree of longitude west from Washington; extending thence due west along said thirty-seventh degree of north latitude to a point formed by its intersection with the thirty-second degree of longitude west from Washington; thence due north along said thirty-second degree of west longitude to a point formed by its intersection with the forty-first degree of north latitude; thence due east along said forty-first degree of north latitude to a point formed by its intersection with the twenty-fifth degree of longitude west from Washington; thence due south along said twenty-fifth degree of west longitude. (Thirty-eighth Congress, first session.)

The south boundary of Colorado was run and marked in 1868 and 1874, and the west boundary in 1878–79. The latter line was retraced and re-marked in 1885. All this was under the General Land Office.

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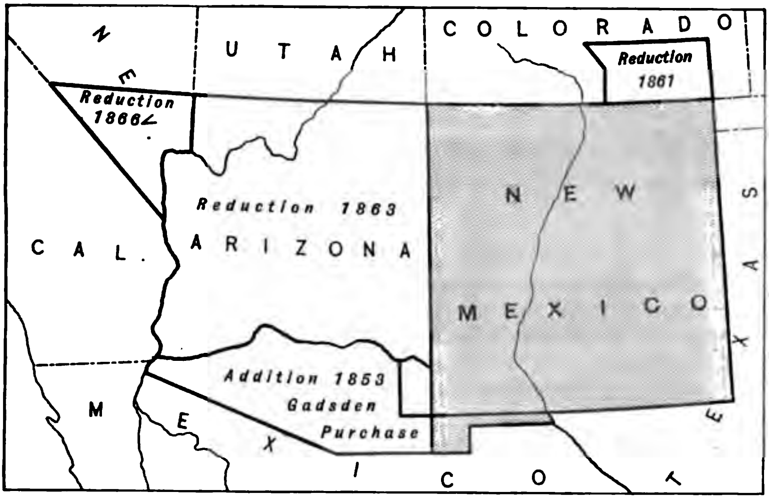
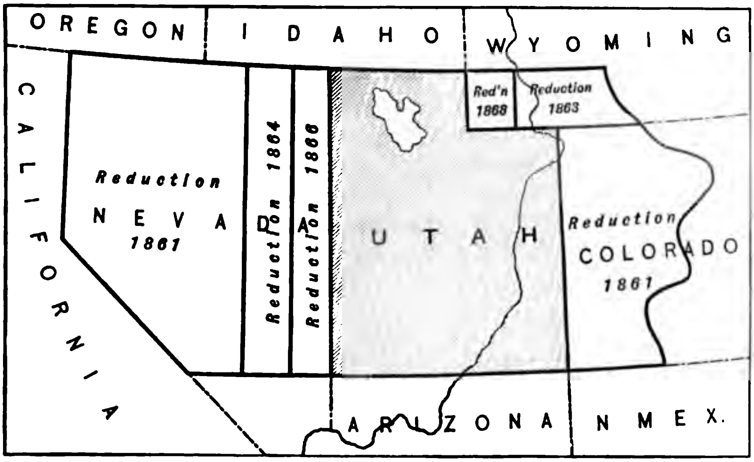


HISTORICAL DIAGRAM OF NEW MEXICO.



HISTORICAL DIAGRAM OF UTAH.

NEW MEXICO.

New Mexico was organized as a Territory on December 13, 1850. Its original area formed a part of the region transferred by Mexico to the United States by the treaty of Guadalupe-Hidalgo and by Texas. It was subsequently enlarged by the Gadsden Purchase. The formation of Colorado Territory in 1861 and of Arizona in 1863 reduced its area to its present limits. (*Vide* Colorado, p. 130, and Arizona, p. 132.)

The following clause from the act creating the Territory gives its original limits:

SECTION 2. And be it further enacted, That all that portion of the territory of the United States bounded as follows: Beginning at a point in the Colorado River, where the boundary line with the Republic of Mexico crosses the same; thence eastwardly with the said boundary line to the Rio Grande; thence following the main channel of said river to the parallel of the thirty-second degree of north latitude; thence east with said degree to its intersection with the one hundred and third degree of longitude west of Greenwich; thence north with said degree of longitude to the parallel of thirty-eighth degree of north latitude; thence west with said parallel to the summit of the Sierra Madre; thence south with the crest of said mountains to the thirty-seventh parallel of north latitude; thence west with said parallel to its intersection with the boundary line of the State of California; thence with said boundary line to the place of beginning—be, and the same is hereby, erected into a temporary government by the name of the Territory of New Mexico. (Thirty-first Congress, first session.)

The present boundaries of New Mexico are as follows: Beginning at the point of intersection of the one hundred and third meridian of longitude west of Greenwich with the thirty-seventh parallel of latitude; running thence south to its point of intersection with the thirty-second parallel of latitude; thence west on this parallel to its intersection with the Rio Grande; thence southerly down the main channel of the Rio Grande to its point of intersection with the boundary line between the United States and Mexico; thence with this boundary to its intersection with the thirty-second meridian of longitude; thence north along this meridian to the thirty-seventh parallel of latitude, and so along that parallel to the point of beginning.

The west boundary of New Mexico was run and marked in 1875, under the General Land Office.

UTAH.

Utah was organized on September 9, 1850, from territory acquired from Mexico by the treaty of Guadalupe-Hidalgo. Its limits originally extended from the eastern boundary of California to the Rocky Mountains, and from the thirty-seventh to the forty-second parallel. This area was reduced by the formation, in 1861, of the Territories of Nevada (*vide* p. 132) and Colorado (*see* p. 130), and in 1864 and 1866 by the extension eastward of the limits of the State of Nevada (*vide* p. 133).

The following is an extract from the act creating the Territory.

> All that part of the territory of the United States included within the following limits, to wit: Bounded on the west by the State of California, on the north by the Territory of Oregon, and on the east by the summit of the Rocky Mountains, and on the south by the thirty-seventh parallel of north latitude, be, and the same is hereby, created into a temporary government, by the name of the Territory of Utah.

The present boundaries of Utah are as follows: Commencing with the intersection of the forty-second parallel of latitude with the thirty-fourth meridian of longitude; running thence south on this meridian to the forty-first parallel of latitude; thence east on this parallel to the thirty-second meridian of longitude; thence south on this meridian to its intersection with the thirty-seventh parallel of latitude; thence west upon this parallel of latitude to its intersection with the thirty-seventh meridian of longitude; thence north on this meridian to its intersection with the forty-seventh parallel of latitude; thence east on the forty-seventh parallel of latitude to the point of beginning.

Utah was admitted as a State on January 4, 1896, with the above boundaries.

Its north boundary, from longitude 34° to 37°, was surveyed and marked in 1871, and its west boundary in 1870, under the General Land Office.

ARIZONA.

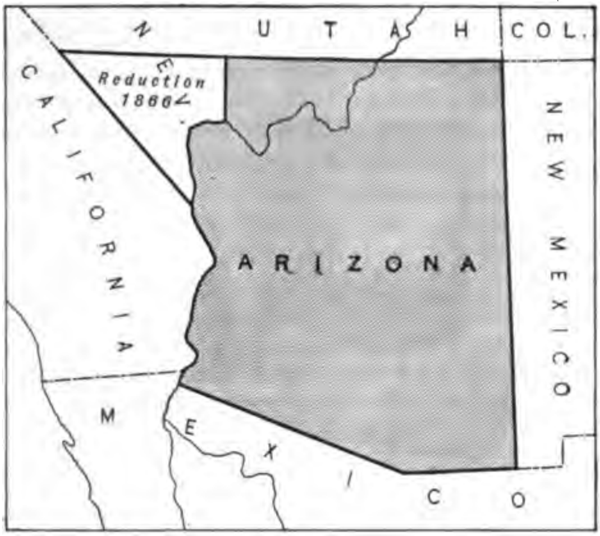
Arizona was organized as a Territory on February 24, 1863. Its area was formerly comprised in the Territory of New Mexico. In 1866 a portion of it was cut off and given to the State of Nevada. (*Vide* Nevada, below.) The following clause from the act creating it gives its limits as originally constituted:

> That all that part of the present Territory of New Mexico situate west of the line running due south from the point where the southwest corner of the Territory of Colorado joins the northern boundary of the Territory of New Mexico to the southern boundary line of said Territory of New Mexico be, and the same is hereby, erected into a temporary government by the name of the Territory of Arizona. (For limits of the piece cut off and added to Nevada, see that State.)

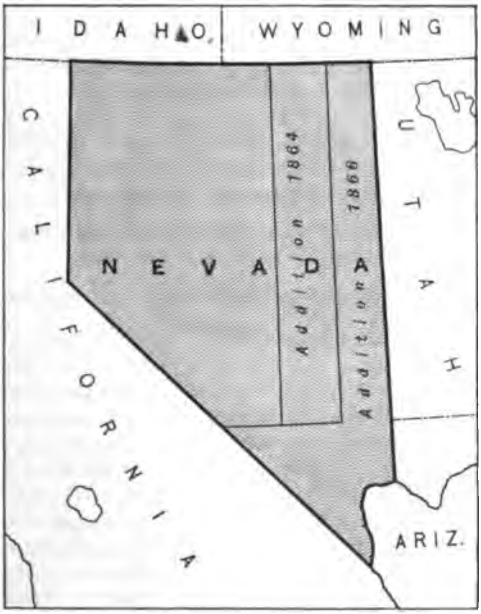
The present boundaries of Arizona are as follows: Beginning at the point of intersection of the thirty-seventh parallel of latitude with the thirty-second meridian of longitude; thence south along this meridian to its intersection with the boundary line between the United States and Mexico; thence with this boundary to the Colorado River; thence up the middle of the main channel of the Colorado River to its point of intersection with the thirty-seventh meridian of longitude; north on this meridian to its intersection with the thirty-seventh parallel; and eastward along the thirty-seventh parallel to the point of beginning.

NEVADA.

Nevada, as originally constituted on March 2, 1861, was formed from territory taken from Utah. Its western boundary was made to conform to the eastern boundary of California (*vide* California, p. 136); its north-



HISTORICAL DIAGRAM OF ARIZONA.



HISTORICAL DIAGRAM OF NEVADA.

ern boundary was, as now, the forty-second parallel; the eastern was the meridian of 39°, and the southern the parallel of 37°. By the enabling act the eastern limit was extended to the thirty-eighth meridian. It was admitted as a State October 31, 1864, with above limits as modified by the enabling act, and in 1866 its eastern limits were still further extended to longitude 37°, and its southern line established as at present, the latter addition having been made from Arizona.

In the act organizing the Territory the boundaries are defined as follows:

Beginning at the point of intersection of the forty-second degree of north latitude with the thirty-ninth degree of longitude west from Washington; thence running south on the line of said thirty-ninth degree of west longitude until it intersects the northern boundary line of the Territory of New Mexico; thence due west to the dividing ridge separating the waters of Carson Valley from those that flow into the Pacific; thence on said dividing ridge northwardly to the forty-first degree of north latitude; thence due north to the southern boundary of the State of Oregon; thence due east to the place of beginning. (Thirty-sixth Congress, second session.)

The following is the text of that portion of the enabling act relating to boundaries:

SEC. 2. That the said State of Nevada shall consist of all the territory included within the following boundaries, to wit: Commencing at a point formed by the intersection of the thirty-eighth degree of longitude west from Washington with the thirty-seventh degree of north latitude; thence due west along said thirty-seventh degree of north latitude to the eastern boundary line of the State of California; thence in a northwesterly direction along the said eastern boundary line of the State of California to the forty-third degree of longitude west from Washington; thence north along said forty-third degree of west longitude and said eastern boundary line of the State of California to the forty-second degree of north latitude; thence due east along the said forty-second degree of north latitude to a point formed by its intersection with the aforesaid thirty-eighth degree of longitude west from Washington; thence due south down said thirty-eighth degree of west longitude to the place of beginning. (Thirty-eighth Congress, first session.)

The following act makes the addition to its area from Arizona referred to above:

AN ACT concerning the boundaries of the State of Nevada.

That, as provided for and consented to in the constitution of the State of Nevada, all that territory and tract of land adjoining the present eastern boundary of the State of Nevada, and lying between the thirty-seventh and the forty-second degrees of north latitude and west of the thirty-seventh degree of longitude west of Washington, is hereby added to and made a part of the State of Nevada.

SEC. 2. That there is hereby added to and made a part of the State of Nevada all that extent of territory lying within the following boundaries, to wit: Commencing on the thirty-seventh degree of north latitude at the thirty-seventh degree of longitude west from Washington, and running thence south on said degree of longitude to the middle of the river Colorado of the West; thence down the middle of said river to the eastern boundary of the State of California; thence northwesterly along said boundary of California to the thirty-seventh degree of north latitude; and thence east along said degree of latitude to the point of beginning. (Thirty-ninth Congress, first session.)

The present limits of Nevada are as follows:

The east boundary is the thirty-seventh meridian of longitude, extending from the forty-second parallel of latitude southward to its intersection with the middle of the Colorado River; thence following the mid-channel of the Colorado River down to the point where it intersects the thirty-fifth parallel of latitude; the southwest boundary is the arc of a great circle running from the last-mentioned point and the point of intersection of the one hundred and twentieth degree of longitude west of Greenwich with the thirty-ninth parallel of latitude; the west boundary is the one hundred and twentieth degree of longitude west of Greenwich; the north boundary is the forty-second parallel of latitude.

The north boundary was surveyed and marked in 1873, and the west boundary, from latitude 42° south to Lake Tahoe and thence southeast to Colorado River, in latitude 35°, in 1872, under the General Land Office. Between 1890 and 1899 the United States Coast and Geodetic Survey, under an appropriation by Congress, ran a new line from Lake Tahoe to Colorado River, differing widely in some places from the former line. At this writing this line has not yet been accepted as the boundary.

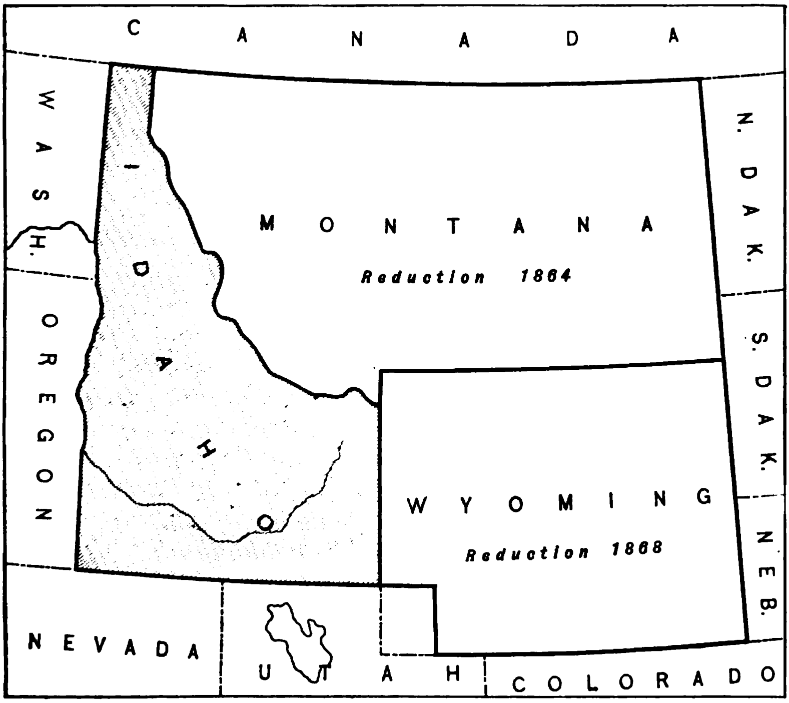
IDAHO.

The Territory of Idaho was formed March 3, 1863, from parts of Washington, Dakota, and Nebraska. Its original limits, which included, besides the present territory, all of Montana and Wyoming, were given as follows in the act organizing the Territory:

> That all that part of the territory of the United States included within the following limits, to wit: Beginning at a point in the middle channel of the Snake River where the northern boundary of Oregon intersects the same; then follow down said channel of Snake River to a point opposite the mouth of the Kooskooskia, or Clearwater River; thence due north to the forty-ninth parallel of latitude; thence east along said parallel to the twenty-seventh degree of longitude west of Washington; thence south along said degree of longitude to the northern boundary of Colorado Territory; thence west along said boundary to the thirty-third degree of longitude west of Washington; thence north along said degree to the forty-second parallel of latitude; thence west along said parallel to the eastern boundary of the State of Oregon; thence north along said boundary to the place of beginning. (Thirty-seventh Congress, third session.)

From this were formed Montana in 1864 (*vide* Montana, p. 129), and Wyoming (*vide* Wyoming, p. 130), in 1868, thereby reducing this territory, with the small addition made in 1873 (*vide* Montana, p. 129), to its present limits.

The present boundary line of Idaho is as follows: Beginning at the intersection of the thirty-ninth meridian with the boundary line between the United States and the British Possessions, it follows said meridian south until it reaches the summit of the Bitter Root Mountains; thence southeastward along the crest of the Bitter Root range and the continental divide until it intersects the meridian of thirty-four degrees of longitude; thence southward on this meridian to the forty-second parallel



HISTORICAL DIAGRAM OF IDAHO.

of latitude; thence west on this parallel of latitude to its intersection with a meridian drawn through the mouth of the Owyhee River; north on this meridian to the mouth of the Owyhee River; thence down the mid-channel of the Snake River to the mouth of the Clearwater; and thence north on the meridian which passes through the mouth of the Clearwater to the boundary line between the United States and the British Possessions; and east on said boundary line to the place of beginning.

On July 3, 1890, Idaho was admitted as a State, with the above limits.

The west boundary of Idaho, from the mouth of Clearwater River to the forty-ninth parallel, was surveyed and marked in 1873–74. The longitude of this line has been determined by the United States Geological Survey to be 117° 02′ 34″. The west boundary, from the mouth of Owyhee River south to the Nevada boundary, was surveyed and marked in 1867. Its longitude has been determined as 117° 01′ 56″ by the United States Geological Survey. Both these lines were run under the General Land Office.

OREGON.

Oregon Territory was organized August 14, 1848. The grounds of our title to its area are obscure. In treating with Great Britain for the establishment of our northern boundary west of the Rocky Mountains this region was claimed on three grounds—that of discovery and occupation, the Louisiana purchase, and cession from Spain. On which of these grounds we succeeded in having the boundary established on the forty-ninth parallel will never be ascertained, and is of little moment.

The Territory as originally established extended from the forty-second to the forty-ninth parallel, and from the Pacific Ocean to the crest of the Rocky Mountains, with boundaries defined in the organizing act as follows:

> All that part of the territory of the United States which lies west of the summit of the Rocky Mountains, north of the forty-second degree of north latitude, known as the Territory of Oregon, shall be organized into and constitute a temporary government by the name of the Territory of Oregon. (Thirtieth Congress, first session.)

In 1853 the Territory was reduced by the formation of Washington Territory (*vide* Washington, p. 136), and on February 14, 1859, it was admitted as a State with its present boundaries. These are defined below in an extract from the State constitution:

> Beginning one marine league at sea due west from the point where the forty-second parallel of north latitude intersects the same; thence northerly, at the same distance from the line of the coast lying west and opposite the State, including all islands within the jurisdiction of the United States, to a point due west and opposite the middle of the north ship channel of the Columbia River; thence easterly to and up the middle channel of said river, and where it is divided by islands, up the middle of the widest channel thereof, and in like manner up the middle of the main channel of Snake River to the mouth of the Owyhee River; thence due south to the parallel

of latitude forty-two degrees north; thence west along said parallel to the place of beginning, including jurisdiction in civil and criminal cases upon the Columbia River and Snake River concurrently with States and Territories of which those rivers form a boundary in common with this State. But the Congress of the United States, in providing for the admission of this State into the Union, may make the said northern boundary conform to the act creating the Territory of Washington.

The boundary line between Oregon and Washington on the forty-sixth parallel of latitude was surveyed and marked in 1864, under the General Land Office.

WASHINGTON.

This was organized March 2, 1853, from a part of Oregon Territory. Its limits, as originally constituted, were as given in the following clause from the act of Congress creating it:

> That from and after the passage of this act all that portion of Oregon Territory lying and being south of the forty-ninth degree of north latitude, and north of the middle of the main channel of the Columbia River from its mouth to where the forty-sixth degree of north latitude crosses said river, near Fort Walla Walla, thence with said forty-sixth degree of latitude to the summit of the Rocky Mountains, be organized into and constitute a temporary government by the name of the Territory of Washington. (Thirty-second Congress, second session.)

In 1859, on the formation of the State of Oregon, the residue of the Territory of Oregon, being the portion lying east of the present limits of the State, extending thence to the crest of the Rocky Mountains, was added to Washington. This area, with the part of Washington lying east of its present limits, was included in Idaho on the formation of that Territory in 1863.

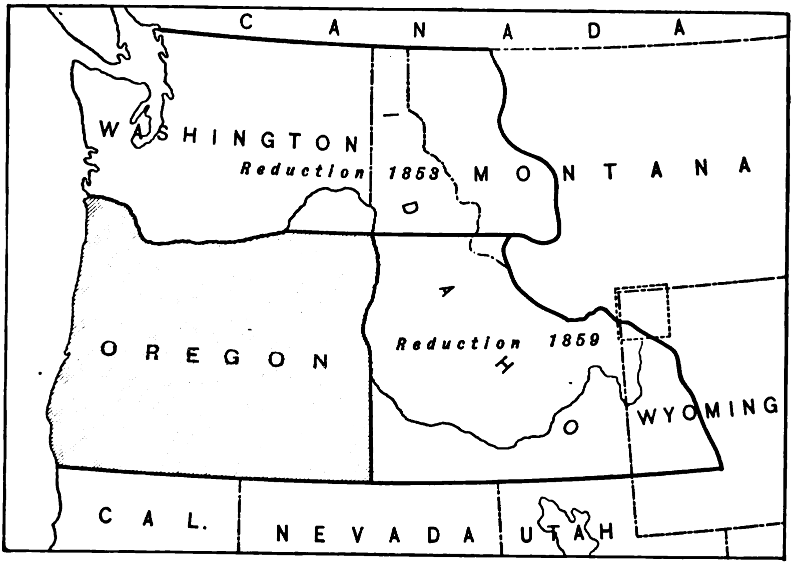
The present boundaries of Washington Territory are as follows: Beginning on the coast at the mouth of the Columbia River; following up the main channel of the Columbia River to its point of intersection with the forty-sixth parallel of latitude; thence east on the forty-sixth parallel to the Snake River; thence down the main channel of the Snake River to the mouth of the Clearwater; thence north on the meridian which passes through the mouth of the Clearwater to the boundary line between the United States and the British possessions; thence west with that boundary line to the Pacific.

Washington was admitted as a State on November 11, 1889, with its limits as above defined.

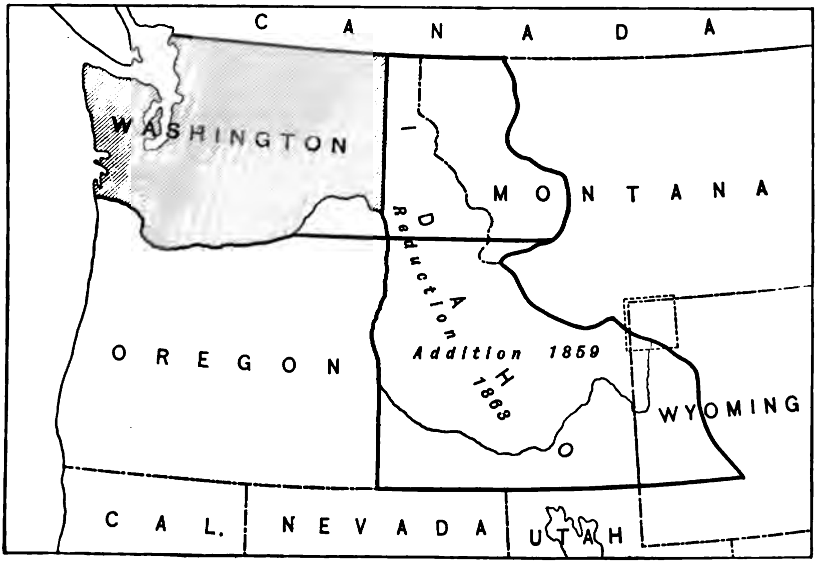
CALIFORNIA.

California was admitted to the Union on September 9, 1850. Its area was taken from territory acquired from Mexico by the treaty of Guadelupe-Hidalgo. Its limits, as defined in the State constitution, are as follows:

> Commencing at the point of intersection of forty-second degree of north latitude with the one hundred and twentieth degree of longitude west from Greenwich, and running south on the line of said one hundred and twentieth degree of west longitude until it intersects the thirty-ninth degree of north latitude; thence running in



HISTORICAL DIAGRAM OF OREGON.



HISTORICAL DIAGRAM OF WASHINGTON.

a straight line in a southeasterly direction to the river Colorado, at a point where it intersects the thirty-fifth degree of north latitude; thence down the middle of the channel of said river to the boundary line between the United States and Mexico as established by the treaty of May 30, 1848; thence running west and along said boundary line to the Pacific Ocean, and extending therein three English miles; thence running in a northwesterly direction and following the direction of the Pacific coast to the forty-second degree of north latitude; thence on the line of said forty-second degree of north latitude to the place of beginning. Also all the islands, harbors, and bays along and adjacent to the Pacific coast.

The northern boundary was surveyed and marked in 1868–69, under the General Land Office.

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OF THE

UNITED STATES

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No. 172

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1900

UNITED STATES GEOLOGICAL SURVEY

CHARLES D. WALCOTT, DIRECTOR

BIBLIOGRAPHY AND INDEX

OF

NORTH AMERICAN GEOLOGY, PALÉONTOLOGY, PETROLOGY AND MINERALOGY

FOR

THE YEAR 1899

BY

FRED BOUGHTON WEEKS

WASHINGTON
GOVERNMENT PRINTING OFFICE
1900

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LETTER OF TRANSMITTAL.

DEPARTMENT OF THE INTERIOR,
UNITED STATES GEOLOGICAL SURVEY,
DIVISION OF GEOLOGY,
Washington, D. C., June 12, 1900.

SIR: I have the honor to transmit herewith the manuscript of a Bibliography and Index of North American Geology, Paleontology, Petrology, and Mineralogy for the Year 1899, and to request that it be published as a bulletin of the Survey.

Very respectfully,

F. B. WEEKS.

Hon. CHARLES D. WALCOTT,
Director United States Geological Survey.

BIBLIOGRAPHY AND INDEX OF NORTH AMERICAN GEOLOGY, PALEONTOLOGY, PETROLOGY, AND MINERALOGY FOR THE YEAR 1899.

By Fred Boughton Weeks.

INTRODUCTION.

The method of preparing and arranging the material of the Bibliography and Index for 1899 is similar to that adopted for the previous publications on this subject (Bulletins Nos. 130, 135, 146, 149, 156, and 162). Several papers that should have been entered in the previous bulletins are here recorded and the date of publication is given with each entry.

Bibliography.—The bibliography consists of full titles of separate papers, classified by authors, an abbreviated reference to the publication in which the paper is printed, and a brief summary of the contents, each paper being numbered for index reference. The extent of papers less than a single page in length is indicated as $\frac{1}{8}$ p., 5 l (lines).

Index.—The subject headings, their subdivision and arrangement, are shown in the Classified Key to the Index. They comprise geographic, geologic, mineralogic, paleontologic, and petrologic subdivisions. Under Economic Geology is given a list of the useful minerals and ores described in publications examined; under Mineralogy, a list of minerals described in such publications; under Paleontology, a list of genera and species of fossils therein described, and under Petrology, a list of rocks described, reference being made in each case, by author's name and number of article in the Bibliography, to the pape. in which the fossil, mineral, or rock is described.

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N. Y. Geol. Surv., 16th Ann. Rept., pp. 29–162, 9 pls., 106 figs., 1899.

Describes the geologic relations and vertical range of the genera and species.

97 **Clarke** (John M.). Notes on the early stages of certain Goniatite
N. Y. Geol. Surv., 16th Ann. Rept., pp. 163–170, 7 figs., 1899.

98 —— Upper Silurian fauna of the Rio Trombetas, State of Par Brazil, and Devonian mollusks from the State of Par Brazil.
Archivos do Museu Nacional do Rio de Janeiro, vol. x. Review: A Geol., vol. xxiv, pp. 311–317, 1899.

99 —— Geological time.
Science, new ser., vol. x, pp. 695, 1899.
Describes certain methods previously employed by which to estim geologic time.

100 —— (a) Paropsonema: A peculiar echinoderm from the Intume cens fauna, New York. (b) Remarkable occurrence Orthoceros in the Oneonta sandstones of New York. The Squaw Island "Water biscuit," Canandaigua Lake, Ne York.
Abstracts: Am. Assoc. Adv. Sci., Proc., vol. xlviii, p. 226 (¼ p Science, new ser., vol. x, pp. 488–489 (⅓ p.), 1899.

101 —— and **Schuchert** (Charles). The nomenclature of the Ne York series of geological formations.
Science, new ser., vol. x, pp. 874–878, 1899.
Discusses the applications which have been made of the subdivisio of the New York series, and proposes a series of names derived fr characteristic New York localities.

102 —— **Hall** (J.) and. A memoir on the Paleozoic reticulate spong constituting the family Dictyospongidæ, Part I.
See Hall (J.) and Clarke (J. M.), Nos. 275 and 276.

103 —— —— A memoir on the Paleozoic reticulate sponges cons tuting the family Dictyospongidæ, Part II.
See Hall (J.) and Clarke (J. M.), Nos. 275 and 277.

104 **Clements** (J. Morgan). Contributions to the study of conta metamorphism.
Am. Jour. Sci., 4th ser., vol. vii, pp. 81–90. Abstracts: Am. Geol., v xxiv, pp. 254–255; Am. Nat., vol. xxxiii, pp. 551–552, 1899.
Describes contact metamorphism of Mansfield slates in the up peninsula of Michigan.

105 —— and **Smyth** (H. L.). The Crystal Falls iron-bearing distr of Michigan. With a chapter on the Sturgeon River tong by W. S. Bayley, and an introduction by C. R. Van Hi
U. S. Geol. Surv., Mon. XXXVI, 512 pp., 53 pls., 24 figs.; 19th A Rept., Pt. III, pp. 19–151, pls. i–xi, figs. 1–6, 1899. Review: Am. Ge vol. xxiv, pp. 308–311, 1899.
Describes the physiography of the region and the occurrence a character of the Archean and Algonkian formations and of the iron- deposits. Includes geologic maps.

106 **Coleman** (Arthur P.). Lake Iroquois and its predecessor at Toronto [Canada.]

Geol. Soc. Am. Bull., vol. x, pp. 165–176, 1899. Abstracts: Am. Geol., vol. xxxiii, pp. 103–104 (½ p.); Science, new ser., vol. ix, pp. 143–144, 1899.

Describes glacial features of the region.

107 —— A new analcite rock from Lake Superior.

Jour. of Geol., vol. vii, pp. 431–436, 1899.

Describes the occurrence and petrographic and chemical characters.

108 —— Corundiferous nepheline syenite from eastern Ontario.

Jour. Geol., vol. vii, pp. 437–444, 1899.

Describes occurrence and petrographic character.

109 —— Copper regions of the upper lakes [Ontario].

Ont. Bur. of Mines, vol. viii, pp. 121–174, 12 pls., 1899.

Describes the general physiographic and geologic features of the region and the character and occurrence of the Archean rocks and Algonkian and Pleistocene deposits. Includes notes on the petrographic characters of the igneous rocks.

110 —— Corundiferous nephelite syenite.

Ont. Bur. of Mines, vol. viii, pp. 250–253, 1899.

Describes character and occurrence in Ontario.

111 —— Copper in Parry Sound district [Ontario].

Ont. Bur. of Mines, vol. viii, pp. 259–262, 1899.

Describes character and occurrence of copper ores.

112 —— and **Willmott** (A. B.). Michipicoton iron range.

Ont. Bur. of Mines, vol. viii, pp. 254–258, 1899.

Describes occurrence of iron in the region.

113 **Colquhoun** (A. J.). Notes on occurrence of quicksilver in Canada.

Can. Min. Inst. Jour., vol. ii, pp. 13–16; Can. Min. Rev., vol. xviii, pp. 41–42; Min. and Sci. Press, vol. lxxix, p. 288, 1899.

114 **Comely** (V. R. de). The gold resources of Mexico.

Eng. and Min. Jour., vol. lxvii, pp. 320–321, 348, 1899.

Describes general occurrence of auriferous veins and placers.

115 **Cooper** (A. S.). The genesis of petroleum and asphaltum in California.

Cal. State Min. Bureau Bull., No. 16, 89 pp., 29 figs., 1899.

116 —— The genesis of petroleum and asphaltum in California.

Min. and Sci. Press, vol. lxxviii, pp. 124, 149, 182, 205 (2 figs.), 236 (1 fig.), 264 (2 figs.), 289–290 (1 fig.), 320 (1 fig.), 344 (2 figs.), 377 (1 fig.), 401–402, 432 (1 fig.), 460 (1 fig.), 1899.

Describes occurrence and discusses origin.

117 **Cooper** (A. S.). Phenomena accompanying the accumulations c bitumen.

Min. and Sci. Press, vol. lxxix, pp. 632–633 (3 figs.), 665 (3 figs.). 69 (1 fig.), 721, 1899.

Describes occurrences.

118 **Cope** (Edward D.). Vertebrate remains from Port Kenned bone deposit [Pennsylvania].

Phil. Acad. Nat. Sci. Jour., 2nd ser., vol. xi, pt. ii, pp. 193–267, pl xix–xxi, 1899.

119 **Crook** (A. R.). Oliver Marcy, LL. D.

Am. Geol., vol. xxiv, pp. 67–72, pl. iv, 1899.

Gives a sketch of Professor Marcy's life.

120 **Crosby** (W. O.). Archean-Cambrian contact near Manitou, Colorado.

Geol. Soc. Am., Bull., vol. x, pp. 141–164, pls. xiv–xviii, 38 figs. 189 Abstracts: Am. Geol., vol. xxiii, p. 92; Science, new ser., vol. ix, p. 1 (½ p.), 1899.

Describes the contact, the structural features, modes of erosion, an the relation of the form of the contacts and the character of the ove lying sediments.

121 —— Geology of the Wachusett dam and Wachusett aqueduc tunnel of the Metropolitan waterworks in the vicinity c Clinton, Massachusetts.

Tech. Quart., vol. xii, pp. 68–96, 10 figs., 1899.

Describes the character and occurrence of the sedimentary and igneou rocks and structure features of the region.

122 —— Geological history of the Nashua Valley during the Tertiary and Quaternary periods.

Tech. Quart., vol. xii, pp. 288–324, 4 pls., 1899.

Describes the physiography and character of the Tertiary and Pleist cene drainage.

123 —— [Review of "The genesis of bitumens as related to chem cal geology," by S. F. Peckham.]

Am. Geol., vol. xxiii, p. 327 (4 l.), 1899.

124 —— [Review of "Notes on North Carolina minerals," by J. H Pratt.]

Am. Geol., vol. xxiii, pp. 325–326, (½ p.), 1899.

125 —— [Review of "The origin and chemical composition of petro leum," by S. P. Sadtler, S. F. Peckham, David T. Day Francis C. Phillips, and Charles F. Mabery.]

Am. Geol., vol. xxiii, pp. 326–327, 1899.

126 **Crosby** (W. O.). [Review of "Origin of grahamite," by I. C. White; "A contribution to the study of contact metamorphism," by J. Morgan Clements; "The petrographical province of Essex County, Mass.," by H. S. Washington; and "A contribution to the geology of the pre-Cambrian igneous rocks of the Fox River Valley, Wisconsin," by Samuel Weidman.]

Am. Geol., vol. xxiv, pp. 253–257, 1899.

127 —— The glacial lake of Nashua Valley.

Abstracts: Am. Geol., vol. xxiii, pp. 102–103 (½ p.); Science, new ser., vol. ix, p. 106 (½ p.), 1899.

128 **Cross** (Whitman). Telluride folio, Colorado.

U. S. Geol. Survey, Geol. Atlas of U. S., folio No. 57, 1899.

Describes the general physiography and geology of the San Juan region, and the occurrence and character of the Algonkian, Juratrias, Cretaceous, Tertiary, and igneous rocks of the quadrangle and discusses the geologic history. Includes topographic and geologic maps, columnar sections, and special illustrations.

129 —— See **Hill** (R. T.). No. 313.

130 **Cummings** (Uriah). American cements.

Rogers and Manson, Boston, 299 pp., 1898. Review: Jour. of Geol., vol. vii, p. 627 (½ p.), 1899.

131 **Curtis** (G. C.) and **Woodworth** (J. B.). Nantucket, a morainal island.

Jour. of Geol., vol. vii, pp. 226–236, 5 figs., 1899.

Describes the physiographic, glacial, and general geologic features of the region.

132 **Cushing** (H. P.). Augite-syenite gneiss near Loon Lake, New York.

Geol. Soc. Am., Bull., vol. x, pp. 177–192, pls. 19–20, 1899. Abstracts: Am. Geol., vol. xxiii, pp. 106, 330–331; Science, new ser., vol. ix, p. 141, 1899.

Describes megascopic, microscopic, and chemical character of the gneiss and its occurrence in the petrographic provinces. Discusses sequence of eruptions in the Adirondacks.

133 —— Report on the boundary between the Potsdam and pre-Cambrian rocks of the Adirondacks [New York].

N. Y. Geol. Surv., 16th Ann. Rept., pp. 5–27, 1 pl., 2 figs. 1899. Review: Am. Geol., vol. xxiii, p. 330, 1899.

Describes the geologic history and local geologic features of the region.

D.

134 **Dale** (T. Nelson). The slate belt of eastern New York and western Vermont.

U. S. Geol. Surv., 19th Ann. Rept., Pt. III, pp. 153–300, pls. xii–xli, figs. 7–16, 1899.

Describes the physiography, the occurrence, and character and structure of the Cambrian and Ordovician beds, the chemical composition of the slates, and the economic geology of the region. Includes a bibliography of the subject.

135 **Dall** (Wm. H.) Synopsis of the Recent and Tertiary Leptonac of North America and the West Indies.

U. S. Nat. Mus., Proc., vol. xxi, pp. 873–897, pls. lxxxvii–lxxxviii, 18

136 **Daly** (R. A.). On the optical characters of the vertical zone amphiboles and pyroxenes; and on a new method of dete mining the extinction angles of these minerals by means cleavage planes.

Am. Acad. Arts and Sci., Proc., vol. xxxiv, pp. 309–323, pls. i–iii, 18

137 —— On a new variety of hornblende.

Am. Acad. Arts and Sci., Proc., vol. xxxiv, pp. 431–437, 1899.

138 —— The peneplain. A review.

Am. Nat., vol. xxxiii, pp. 127–138, 1899.

Discusses Professor Tarr's criticisms of the peneplain theory.

139 **Darton** (Nelson Horatio). Preliminary report on the geology a water resources of Nebraska west of the one hundred a third meridian.

U. S. Geol. Surv., 19th Ann. Rept., Pt. IV, pp. 719–785, pls. lxxiv–cxv figs. 208–230, 1899.

Describes the physiography, the character and occurrence of t Pleistocene, Tertiary, and Cretaceous strata and of the undergrou waters.

140 —— The bad lands of South Dakota.

Nat. Geog. Mag., vol. x, pp. 339–343, 3 pls., 1899.

Describes the general geologic and physiographic features of t region.

141 —— Fossil fish in Jurassic of Black Hills.

Abstracts: Am. Geol., vol. xxiii, p. 93 (4 l.), 1899; Science, new se vol. ix, p. 103 (7 l.), 1899.

141*a* —— Mesozoic stratigraphy in southwestern Black Hills.

Abstracts: Am. Geol., vol. xxiii, p. 94 (⅓ p.), 1899; Science, new se vol. ix, p. 103 (⅓ p.), 1899.

141*b* —— Relations of Tertiary formations in western Nebraska regio

Abstracts: Am. Geol., vol. xxiii, p. 94 (½ p.), 1899; Science, new se vol. ix, p. 103 (5 l.), 1899.

141*c* —— Shore line of Tertiary lakes on slope of the Black Hills.

Abstracts: Am. Geol., vol. xxiii, p. 94 (9 l.), 1899; Science, new se vol. ix, p. 103 (8 l.), 1899.

142 —— **Clarke** (F. W.) and. Hydromica from New Jersey.

See Clarke (F. W.) and Darton (N. H.), No. 95.

143 **Davis** (H. J.). Modification in the Jonathan Creek draina basin [Ohio.]

Denison Univ., Sci. Lab. Bull., vol. xi, art. viii, pp. 163–165, pls. xx xxvi, 1899.

Describes the physiographic features of the region.

144 **Davis** (W. M.). The peneplain.

Am. Geol., vol. xxiii, pp. 207–239, pl. vii, 1899.

Discusses evidences bearing on the existence of peneplains.

145 **Davison** (J. M.). Platinum and iridium in meteoric iron.

Am. Jour. Sci., 4th ser., vol. vii, p. 4, 1899. Review: Am. Geol., vol. xxiii, p. 327 (9 l.), 1899.

146 **Dawson** (George M.). Summary report of the Geological Survey department [Canada] for the year 1897.

Can. Geol Surv., new ser., vol. x, Rept. A, 156 pp. and map, 1898.

Contains a general summary of the operations of the survey and of the annual reports of the several geologists.

147 —— Summary report of the Geological Survey department of [Canada] for the year 1898.

Can. Geol. Surv., 208 pp., 1899. Review: Am. Geol., vol. xxiii, pp. 384–385,1899.

148 —— The coals of the Canadian northwest and Rocky Mountain region.

The Mineral Industry for 1898, vol. vii, pp. 198–201, 1899.

Describes occurrence and distribution.

149 —— A remarkable landslip on the Riviere Blanche, Port Neuf Co., Quebec.

Abstracts: Am. Geol., vol. 23, p. 103 (½ p.); Science, new ser., vol. ix, p. 139 (9 l.), 1899.

150 —— Duplication of geologic formation names.

Science, new ser., vol. ix, pp. 592–593, 1899.

Discusses use of the name Cache Creek formation.

151 **Dawson** (Sir J. William). Note on an echinoderm collected by Dr. Ami at Bessrers, Ottawa River, in the Pleistocene (Leda clay).

Ottawa Nat., vol. xiii, pp. 201–202, 1899.

Contains notes on a specimen representing a species of Spatangus or Brissus.

152 —— Addendum to a note of Nova Scotia Carboniferous Entomostraca in number for January, 1897.

Can. Rec. Sci., vol. vii, p. 396, fig. 10, 1898.

Gives figure of Carbonia rankiniana.

153 **Day** (David T.). Mineral Resources of the Antilles, Hawaii, and the Philippines.

Eng. Mag., vol. xvii, pp. 242–251, 1899.

Gives a general account of the mineral resources of these islands.

154 **Day** (William C.). The coal and pitch coal of the Newport mine [Oregon].

U. S. Geol. Surv., 19th Ann. Rept., Pt. III, pp. 370–376, 1899.

Discusses the character and origin of certain portions of these coal beds.

155 **Day** (William C.). See **Taff** (J. A.). No. 617.

156 **Dickhaut** (Henry E.). Collecting fossils in the Cincinnati shale

Am. Geol., vol. xxiii, pp. 335–336, 1899.

Contains notes on the occurrence of fossils in these shales and reco mendations as to the best part of the year to collect fossils from th region.

157 **Diller** (Joseph Silas). The Coos Bay coal field, Oregon.

U. S. Geol. Surv., 19th Ann. Rept., Pt. III, pp. 309–376, pls. xliii–li figs. 17–76, 1899.

Describes the topographic and geologic features of the region and t occurrences and character of the coals.

158 —— Origin of Paleotrochis.

Am. Jour. Sci., 4th ser., vol. vii, pp. 337–342, 1899. Review: A Geol., vol. xxiv, p. 182 (½ p.), 1899.

Describes microscopic characters of the material and origin of t Paleotrochis structure.

159 —— Crater Lake, Oregon.

Smith. Inst., Ann. Rept. for 1897, pp. 369–379, pls. ii–xvi, 1898.

160 —— Latest volcanic eruption on the Pacific coast.

Science, new ser., vol. ix, pp. 639–640, 1899.

Describes material from Mount St. Helens, Washington.

161 —— The educational series of rock specimens collected and di tributed by the United States Geological Survey.

Abstract: Am. Geol., vol. xxiii, pp. 61–62, 1899.

162 **Domenech** (Manuel Victor). [Mineral resources of Porto Ric

Mines and Minerals, vol. xix, pp. 529–532, 1 fig., 1899.

Describes occurrence of gold, silver, copper, and iron.

163 **Donald** (J. T.). A notable Canadian deposit of chromite.

Can. Min. Inst., Jour., vol. ii, pp. 25–27, 1899; Can. Min. Rev., v xviii, pp. 40–41, 1899.

Contains notes on occurrence.

164 **Douglas** (James). The Copper Queen mine, Arizona.

Min. and Sci. Press, vol. lxxix, pp. 432–433, 2 figs., 1899.

165 **Douvillé** (M. H.). Sur l'âge des couches traversées par le ca de Panama.

Soc. Géol de France, Bull., 3d ser., vol. xxvi, pp. 587–600, 1898.

E.

166 **Eakle** (Arthur S.). Topaz crystals in the mineral collection the U. S. National Museum.

U. S. Nat. Mus. Proc., vol. xxi, pp. 361–369, 22 figs., 1899; publish in 1898.

Describes crystallographic characters.

167 **Eastman** (C. R.). Descriptions of new species of Diplodus teeth from the Devonian of northeastern Illinois.

Jour. of Geol., vol. vii, pp. 489–493, pl. vii, 1899.

Describes two new species of Diplodus.

168 **Eckel** (E. C.). Intrusives in the Inwood limestone of Manhattan Island.

Am. Geol., vol. xxiii, pp. 122–124, pl. iii, 1899.

Describes the relations of the formations and the character and occurrence of the intrusives.

169 **Ehrenfeld** (Frederick). A study of the igneous rocks at York Haven and Stony Brook, Pa., and their accompanying formations.

Thesis presented to the faculty of the department of philosophy of the University of Pennsylvania, 24 pp., 1 pl., 1898. (Not seen.)

170 **Eldridge** (George H.). The extreme southeastern coast. The coast from Lynn Canal to Prince William Sound [Alaska].

U. S. Geol. Surv., Expl. in Alaska, pp. 101–104, 1899.

Describes occurrence of gold and coal in the region.

171 —— The Sushitna drainage area [Alaska].

U. S. Geol. Surv., Expl. in Alaska, pp. 111–112, 1899.

Describes general physiographic and geologic features.

172 —— and **Muldrow** (Robert). Report of the Sushitna expedition [Alaska].

U. S. Geol. Surv., Expl. in Alaska, pp. 15–27, 1899.

Describes the physiography, the character and occurrence of the granite and sedimentary formations, and the geologic structure and mineral resources of the region.

173 **Elftman** (Arthur H.). Preliminary report of field work during the summer 1895.

Minn. Geol. and Nat. Hist. Surv., 24th Ann. Rept., pp. 148–149, 1899.

Brief notes on the occurrence of anorthosytes.

174 —— List of rock samples collected in northeastern Minnesota in 1895, 1896, and 1897 (prepared by U. S. Grant).

Minn. Geol. and Nat. Hist. Surv., 24th Ann. Rept., pp. 150–170, 1899.

175 **Ells** (R. W.). Problems in Quebec geology.

Can. Rec. Sci., vol. vii, pp. 480–502, 1898.

Gives a general review of the publications on Quebec geology and discusses the problems involved.

176 **Emerson** (B. K.). The geology of eastern Berkshire County, Massachusetts.

U. S. Geol. Surv., Bull. No. 159, 139 pp., 9 pls., 16 figs., 1899.

Describes the occurrence, character, and structure of the pre-Cambrian, Cambrian, Silurian, Glacial, and post-Glacial deposits, and gives an account of the mineral resources and a mineral lexicon and bibliography of the region.

177 **Emerson** (B. K.). Differences of batholitic granites, accordi to depth of erosion.

Abstracts: Am. Geol., vol. xxiii, pp. 104–105; Science, new ser., ix, p. 140 (⅓ p.), 1899.

178 **Emmons** (S. F.). Plutonic plugs and subtuberant mountains.

Abstract: Science, new ser., vol. x, pp. 24–25, 1899.

F.

179 **Fairbanks** (Harold W.). Some notes on the petroleum depos of California.

Min. and Sci. Press, vol. lxxviii, p. 533, 1899.

Discusses occurrence and origin.

180 **Fairchild** (Herman Le Roy). Glacial waters in the Finger Lak region of New York.

Geol. Soc. Am., Bull., vol. x, pp. 27–68, pls. iii–ix, 1899.

Describes the glacial lakes that occupied the various valleys of region.

181 —— Glacial Lakes Newberry, Warren, and Dana, in central N York.

Am. Jour. Sci., 4th ser., vol. vii, pp. 249–263, 1 fig., pl. vi, 1899.

Describes general character, extent, and shore lines and elevation the glacial lakes.

182 **Faribault** (E. R.). On the gold measures of Nova Scotia, and de mining.

Can. Min. Inst., Jour., vol. ii, pp. 119–129; Can. Min. Rev., vol. xv p. 78, 1899.

Describes geologic structure and occurrence of gold in the region.

183 **Farrington** (Oliver C.). A fossil egg from South Dakota.

Field Col. Mus., Geol. ser., vol. i, No. 5, pp. 192–200, pls. xx–xxi, f 1–2, 1899.

184 **Finch** (J. W.). [Review of "Iowa Geological Survey, Ann. Re 1898, vol. ix."]

Jour. of Geol., vol. vii, pp. 517–521, 1899.

185 **Fleming** (Mary A.). The potholes of Fosters Flats (now call Niagara Glen) on the Niagara River.

Abstracts: Am. Assoc. Adv. Sci., Proc., vol. xlviii, pp. 226–227 (½ Science, new ser., vol. x, p. 489 (⅓ p.), 1899.

186 **Foerste** (August F.). Age and development of the Cincinn anticline.

Abstract: Science, new ser., vol. x, p. 488 (½ p.), 1899.

187 —— **Shaler** (N. S.), **Woodworth** (J. B.), and. Geology of Narragansett Basin.

See Shaler (N. S.), Woodworth (J. B.), and Foerste (A. F.), No. 582

188 **Fontaine** (W. M.). Notes on Lower Cretaceous plants from the Hay Creek coal field, Crook County, Wyoming.
U. S. Geol. Surv., 19th Ann. Rept., Pt. II, pp. 645–702, pls. clx–clxix, 1899.
Describes the section of the coal beds and the fossils collected.

189 —— See **Ward** (L. F.), No. 690.

190 **Foote** (H. W.), **Penfield** (S. L.) and. Chemical composition of tourmaline.
See Penfield (S. L.) and Foote (H. W), No. 520.

191 **Foote** (Warren M.). Note on a new meteoric iron found near the Tombigbee River, in Choctaw and Sumter counties, Alabama.
Am. Jour. Sci., 4th ser., vol. viii, pp. 153–156, pls. ii–iii, 1899. Review: Am. Geol., vol. xxiv, p. 319 (8 l.), 1899.
Describes the occurrence and physical and chemical characters of the material.

192 —— Note on a new meteoric iron found near Iredell, Bosque County, Texas, U. S. A.
Am. Jour. Sci., 4th ser., vol. viii, pp. 415–416, 1899.
Describes occurrence and chemical character of the material.

193 **Forsyth** (A.), **O'Harra** (C. C.) and. Notes on the geology and mineral deposits of a portion of the southern Black Hills.
See O'Harra (C. C.) and Forsyth (A.), No. 502.

194 **Fowler** (S. S.). Notes on the Ymir mine and its mill practice [British Columbia].
Min. and Sci. Press, vol. lxxix, p. 517, 1899.
Describes geologic features and occurrence of gold and silver ores.

195 **Fuller** (Myron L.). Season and time elements in sand-plain formation.
Jour. of Geol., vol. vii, pp. 452–462, 1 fig., 1899.
Discusses origin of certain glacial deposits.

196 —— Notes on an unusual orientation of phenocrysts in a dike.
Tech. Quart., vol. xii, pp. 175–179, 2 figs., 1899.
Describes phenocrysts of a porphyritic granite.

197 —— The occurrence and uses of mica.
Stone, vol. xix, pp. 530–532, 1899.

198 —— [Review of "Mineralogical notes, analyses of tysonite, bastnasite, prosopite, jeffersonite, covellite," etc., by W. F. Hillebrand.]
Am. Geol., vol. xxiii, pp. 324–325 (½ p.), 1899.

199 **Fuller** (Myron L.). [Review of "On the chemical compositio tourmaline," by S. L. Penfield and H. W. Foote.]
Am. Geol., vol. xxiii, p. 325 (½ p.), 1899.

200 —— [Review of "On dikes of felsophyre and basalt in Paleo rocks in central Appalachian Virginia," by N. H. Dar and "Notes on the petrography," by Arthur Keith.]
Am. Geol., vol. xxiii, p. 327 (6 l.), 1899.

201 —— [Review of "Platinum and iridium in meteoric iron," b M. Davison.]
Am. Geol., vol. xxiii, p. 327, (9 l.), 1899.

202 —— [Review of "Causes of variation in composition of ign rocks," by T. L. Walker.]
Am. Geol., vol. xxiii, pp. 327–328, (⅓ p.), 1899.

203 —— [Review of "On the associated minerals of rhodolite,' W. E. Hidden and J. H. Pratt.]
Am. Geol., vol. xxiii, p. 328 (5 l.), 1899.

204 —— [Review of "The alkaline reaction of some natural silica by F. W. Clarke.]
Am. Geol., vol. xxiii, p. 328 (7 l.), 1899.

205 —— [Review of "Petroleum inclusions in quartz crystals," Chas. L. Reese.]
Am. Geol., vol. xxiii, p. 328 (3 l.), 1899.

206 —— [Review of "Mineral resources of Cuba," by Raimu Cabrera.]
Am. Geol., vol. xxiii, p. 328 (3 l.), 1899.
See Bibliography and Index for 1899, No. 117.

207 —— [Review of "The slate region of Pennsylvania," by M field Merriam.]
Am. Geol., vol. xxiii, p. 328 (5 l.), 1899.

208 —— [Review of "On the phenocrysts of intrusive igneous roc by L. V. Pirsson; "On the occurrence, origin, and ch ical composition of chromite," by J. H. Pratt; "S rock-forming biotites and amphiboles," by H. W. Tur "On the occurrence of Paleotrochis in volcanic rock Mexico," by H. S. Williams; "Origin of Paleotrochis," J. S. Diller; "Goldschmidtite, a new mineral," by W Hobbs; and "On a hydromica from New Jersey," by F. Clarke and N. H. Darton.]
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251 —— [Review of "The hardystonite, a new calcium zinc silicate from Franklin Furnace, New Jersey," by J. E. Wolff.]
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255 —— **Winchell** (H. V.) and. Preliminary report on the Rainy Lake gold region [Minnesota].
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303 —— Correlations in the Ozark region, a correction.

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U. S. Geol. Surv., 19th Ann. Rept., Pt. III, pp. 301–305, 1899.

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Am. Jour. Sci., 4th ser., vol. vii, pp. 51–57, 1899. Abstract: Am. Geol., vol. xxiii, pp. 324–325 (½ p.), 1899.

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Describes methods of analysis and chemical composition of the material.

318 —— Mineralogical notes, melonite (?), coloradoite, petzite, hessite.

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rocks.

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661 —— [Review of "Wells of northern Indiana," by Fra erett.]

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662 —— [Review of "The fossil bison of North America," b erick A. Lucas.]

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681 **Walcott** (Charles Doolittle). Pre-Cambrian fossiliferous formations.

Geol. Soc. Am., Bull., vol. x, pp. 199–244, pls. xxii–xxviii, 1899. Reviews: Am. Jour. Sci., 4th ser., vol. viii, pp. 78–79; Science, new ser., vol. ix, p. 143 (½ p.), 1899.

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682 —— Cambrian fossils [Yellowstone National Park].

U. S. Geol. Surv., Mon. XXXII, Pt. II, pp. 440–478, pls. lx–lxv. 1899.

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683 —— Cambrian Brachiopoda, Obolus, and Lingulella, with description of new species.

U. S. Nat. Mus., Proc., vol. xxi, pp. 385–420, pls. xxvi–xxviii, 1899. Published in 1898.

684 —— Fossil Medusæ.

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Am. Jour. Sci., 4th ser., vol. vii, pp. 199–204, figs. 1–6, 1899.

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686 —— Causes of variation in the composition of igneous rocks.

Review: Am. Geol., vol. xxiii, pp. 327–328 (½ p.), 1899.

687 **Ward** (H. L.). New Kansas meteorite.

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688 —— Notice of a new meteorite from Murphy, Cherokee County, North Carolina.

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689 —— Notice of an aerolite that recently fell at Allegan, Michigan.

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U. S. Geol. Surv., 19th Ann. Rept., Pt. II, pp. 521–946, pls. liii–clxxii, figs. 117–122, 1899. Review: Jour. of Geol., vol. vii, pp. 814–815, 1899.

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691 **Ward** (Lester F.). Descriptions of the species of Cycadeoidea or fossil Cycadean trunks thus far determined from the Lower Cretaceous rim of the Black Hills.

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See Penfield (S. L.) and Warren (C. H.), No. 522.

693 —— —— Chemical composition of parisite and a new occurrence of it in Ravalli Co., Montana.

See Penfield (S. L.) and Warren (C. H.), No. 521.

694 **Washington** (Henry S.). The petrographical province of Essex County, Massachusetts, II.

Jour. of Geol., vol. vii, pp. 53–64, 1899.

Describes the megascopic, microscopic, and chemical characters of essexite, diorite, and gabbro.

695 —— The petrographical province of Essex County, Massachusetts, III.

Jour. of Geol., vol. vii, pp. 105–121, 1899.

Describes the petrographic and chemical character of aplite, quartz-syenite-porphyry, paisanite, sölvsbergite, tinguaite, and dike rocks.

696 —— The petrographical province of Essex County, Massachusetts, IV.

Jour. of Geol., vol. vii, pp. 284–294, 1899.

Describes petrographic and chemical character of camptonite, diabase, rhyolite, and keratophyr.

697 —— Petrographical province of Essex County, Massachusetts, V. (General discussion and conclusion.)

Jour. of Geol., vol. vii, pp. 463–482, pl. vi, 1899. Review: Am. Geol., vol. xxiv, pp. 255–257, 1899.

Gives a general summary of previous papers.

698 **Watson** (Thomas L.). Some notes on the lakes and valleys of the Upper Nugsuak Peninsula, North Greenland.

Jour. of Geol., vol. vii, pp. 655–666, 3 figs., 1899.

Describes physiographic features of the region and the occurrence and origin of the lake.

699 —— Some further notes on the weathering of diabase in the vicinity of Chatham, Virginia.

Am. Geol., vol. xxiv, pp. 355–369, 1899.

Discusses the evidences of the cause of the considerable loss of alumina in the change from fresh to decomposed diabase. Includes many chemical analyses.

700 **Watts** (W. L.). Notes on the oil-yielding formations of California.

Min. and Sci. Press, vol. lxxix, pp. 144–146 (12 figs.), pp. 172–173 (3 figs.), 1899. Describes character and occurrence.

701 **Weed** (Walter Harvey). Fort Benton folio, Montana.

U. S. Geol. Surv., Geol. Atlas of U. S., folio No. 55, 1899.

Describes the general geologic features and the occurrence and
ter of the Archean, Cambrian, Silurian, Devonian, Carbonifero
trias, Cretaceous, Pleistocene, and igneous rocks. Discusses the
history of the region, and describes the occurrence of coal, g
silver. Includes topographic maps and columnar sections.

702 —— Little Belt Mountains folio, Montana.

U. S. Geol. Surv., Geol. Atlas of U. S., folio No. 56, 1899.

Describes the physiography, the occurrence, and characte
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reticularis Linné, Girty, No. 223.
reticularis (Linnæus), Grabau, No. 229
spinosa Hall, Grabau, No. 229.
Atys robustoides Ald., Harris, No. 281.
Aulopora Goldfuss, Grabau, No. 229.
geometrica n. sp., Girty, No. 223.
serpens Goldf., Grabau, No. 229.
tubæformis Goldf., Grabau, No. 229.
Autodetus Lindström, Grabau, No. 229.
lindstroemi Clarke, Grabau, No. 229.
Avellana bullata Mort., Harris, No. 280.
Avicula (Oxytoma) wyomingensis n. sp., Stanton, No. 608.
Aviculopecten McCoy, Grabau, No. 229.
exacutus Hall, Grabau, No. 229.
insignis Hall, Grabau, No. 229.
occidentalis (Shumard), Girty, No. 222.
princeps (Conrad), Grabau, No. 229.
Bactrites Sandberger, Grabau, No. 229.
Bactrites G. Sandberger, Clarke, No. 96.
aciculum Hall (sp.), Clarke, No. 96.
aciculum (Hall), Grabau, No. 229.
gracilior Clarke, Grabau, No. 229.
gracilior n. sp., Clarke, No. 96.
Baculites anceps, Harris, No. 280.
Baieropsis adiantifolia Fontaine, Fontaine, No. 188.
pluripartita Fontaine?, Fontaine, No. 188.
Bairdia McCoy, Grabau, No. 229.
leguminoides Ulrich, Grabau, No. 229.
Barbatia cuculloides var., Harris, No. 280.
Bathyuriscus Meek?, Walcott, No. 682.
Bellerophon Montfort, Grabau, No. 229.
Bellerophon (sensu stricto), Girty, No. 222.
leda Hall, Grabau, No. 229.
patulus Hall, Grabau, No. 229.
Bellinurus grandævus Jones & Woodw., Jones and Woodward, No. 366.
Beloceras Hyatt, Clarke, No. 96.
iynx n. sp., Clarke, No. 96.
(?) napelesense n. sp., Clarke, No. 96.

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Beltina n. gen., Walcott, No. 681.
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Betula iddingsi n. sp., Knowlton, No. 392.
Beyrichia McCoy, Grabau, No. 229.
hamiltonensis Jones, Grabau, No. 229.
(?) primæva n. sp., Matthew, No. 468.
tricollina Ulrich, Grabau, No. 229.
Billingsella coloradoensis Shumard, Walcott, No. 682.
Bison bison (Linnæus), Lucas, No. 444.
alleni Marsh, Lucas, No. 444.
antiquus Leidy, Lucas, No. 444.
crassicornis Richardson, Lucas, No. 444.
ferox Marsh, Lucas, No. 444.
latifrons (Harlan), Lucas, No. 444.
occidentalis Lucas, Lucas, Nos. 444, 446.
Blarina simplicidens Cope, Cope, No. 118.
Botryllopora Nicholson, Grabau, No. 229.
socialis Nicholson, Grabau, No. 229.
Botryodictya n. gen., Hall and Clarke, Nos. 275, 276.
ramosa (sp.), Hall and Clarke, Nos. 275, 276.
Brittsia n. gen., White, No. 720.
problematica n. sp., White, No. 720.
Bucania ? sp., Weller, No. 711.
Bucanopsis, Girty, No. 222.
Buccinanops ellipticum Whitf., Harris, Nos. 280, 281.
Bullia buccinoides Merriam, Merriam, No. 481.
Bulliopsis choctavensis Ald., Harris, No. 281.
Bunomeryx Wortman, Scott, No. 576.
Cadulus abruptus Ald. and M., Harris, No. 281.
Calamites Suckow, White, No. 720.
cannæformis Schloth., White, No. 719.
cistii Brongn., White, No. 720.
ramosis Artis, White, No. 720.
Calamodendron approximatum (Schloth.) Brongn., White, No. 719.
Calamostachys ovalis Lx. ?, White, No. 720.
Calapœcia Billings, Lambe, No. 413.
canadensis Billings, Lambe, No. 413.
Calathospongia n. gen., Hall and Clarke, Nos. 275, 277.
amphorina n. sp., Hall and Clarke, Nos. 275, 277.
carceralis n. sp., Hall and Clarke, Nos. 275, 277.
carlin, n. sp., Hall and Clarke, Nos. 275, 277.
(?) magnifica, n. sp., Hall and Clarke, Nos. 275, 277.
redfieldi Hall (sp.), Hall and Clarke, Nos. 275, 277.
(?) sacculus Hall (sp.), Hall and Clarke, Nos. 275, 277.
tiffanyi n. sp., Hall and Clarke, Nos. 275, 277.
Callipteridium inæquale Lx., White, Nos. 719, 720.
mansfieldi Lx., White, No. 719.
membranaceum Lx., White, No. 720.
sullivantii (Lx.) Weiss, White, Nos. 719, 720.
Calyptræa aperta Sol., Harris, No. 281.
Calyptraphorus trinodiferus Con., Harris, No. 280.

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Camarophoria ringens Swallow, G 223.
Camarotœchia Hall and Clarke, Gr 229.
camarifera Winchell (?), Girty,
congregata (Conrad), Grabau, N
dotis Hall, Grabau, No. 229.
herrickana n. sp., Girty, No. 223.
horsfordi Hall, Grabau, No. 229.
metallica White, Girty, No. 223.
sappho Hall, Grabau, No. 229.
sappho Hall (?), Girty, No. 223.
sp., Girty, No. 223.
Camelomeryx Scott, Scott, No. 576.
Campophyllum sp., Girty, No. 222.
Camptonectes burlingtonensis Gab No. 280.
bellistriatus Meek, Stanton, No.
var. distans n. var., Stanton,
pertenuistriatus Hall and Whitf ton, No. 603.
platessiformis White, Stanton, N
Cancellaria graciloides Ald., Harris,
var. bella n. var., Harris, No.
lanceolata Ald., Harris, No. 281.
marleana, Harris, No. 281.
quercollis var. greggi, Harris, No
sylværupis Har., Harris, No. 281.
tortiplica Con., Harris, No. 281.
Canis priscolatrans Cope, Cope, No. 1
Cannapora Hall, Lambe, No. 413.
jubciformis Hall, Lambe, No. 413
Capulus expansus Whitf., Harris, No
sp., Weller, No. 711.
Carbonia rankiniana, Dawson, No. 1
Cardiocarpon (Samaropsis) branne and D. W., White, No. 720.
Cardiola Broderip, Grabau, No. 229.
retrostriata von Buch, Grabau, N
Cardiopsis (?) erectus n. sp., Weller,
radiata Meek and Worthen, W 711.
Cardium alabamense, Harris, No. 280
tuomeyi Ald., Harris, No. 280.
Caricaus lævicornus Cope, Cope, No.
sp. Cope, No. 118.
Caricella podagrina Dall., Harris, N
Carpites pedunculatus n. sp., Know 392.
Carpolithus barrensis Ward n. sp.,
No. 188.
fasciculatus Fontaine, No. 188.
fœnarius Ward., n. sp., Fontaine,
montium-nigrorum Ward, n. taine, No. 188.
virginiensis Fontaine, Fontaine,
Cassidaria brevidentata Ald. var., Ha 280, 281.
dubia Ald., Harris, No. 281.
Castanea pulchella n. sp., Knowlton,
Castor fibre Linn, Cope, No. 118.
Celastrophyllum pulchrum n. sp., W 690.

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d *species described*—Continued.
s culveri n. sp., Knowlton, No. 392.
ticus n. sp., Knowlton, No. 392.
qualis n. sp., Knowlton, No. 392.
inensis Ward (?), Hollick, No. 328.
chi n. sp., Hollick, No. 328.
eila Billings, Grabau, No. 229.
ressa Hall, Grabau, No. 229.
taxopis magnifolia Fontaine, Fon-
No. 188.
ictya n. gen., Hall and Clarke, Nos. 5, 276.
ulata Hall (sp.), Hall and Clarke, Nos, 5, 276.
penteriana n. sp., Hall and Clarke, Nos. 5, 276.
eta n. sp., Hall and Clarke, Nos. 275. 3.
ta Hall (sp.), Hall and Clarke, Nos. 5, 276.
ata n. sp., Hall and Clarke, Nos. 275, 3.
ora n. gen., Grabau, Nos. 229, 231.
otoma n. sp., Grabau, Nos. 229, 231.
orta n. sp., Grabau, No. 231.
soni n. sp., Grabau, Nos. 229. 231.
nus monticulatus n. sp., Beede, No. 44.
psis conica Ald., Harris, No. 281.
iatilis Ald., Harris, No. 281.
bropsis n. sp., Harris, No. 281.
m delicatulum Ald., Harris, No. 281.
bigbeense Ald., Harris, No. 281.
s Fischer de Waldheim, Grabau, No. 9.
natus (Conrad), Grabau, No. 229.
oisensis Worthen, Weller, No. 711.
ius Hall, Grabau, No. 229.
nensis Hall and Whitfield, Girty, No. 3.
olobius Norwood and Pratten, Girty, o. 222.
ronatus Hall, Grabau, No. 229.
tus Shumard, Girty, No. 223.
alus Hall, Grabau. No. 229.
gerus (Hall), Grabau, No. 229.
nus (Castelnau), Grabau, No. 229.
hyllum canadense Billings sp., Lambe, o. 414.
phale Billings, sp., Lambe, No. 414.
omus engonata Heilp., Harris, No. 281.
ta Ald., Harris, No. 281.
omum buchi Heer, Hollick, No. 328.
uchzeri Heer (?), Hollick, No. 328.
nnense Wat., Hollick, No. 328.
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ingens Lx., Ward, No. 690.
burlisæfolius Lx., Ward, No. 590.
aguei n. sp., Knowlton, No. 392.
ra jamaicensis n. sp., Vaughan, No. 2.
s claypolei, Hay, No. 286.
iger, Hay, No. 286.
leris parva Fontaine ?, Fontaine, No. 3.
mingensis n. sp., Fontaine, No. 188.

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Genera and species described—Continued.
Cladopora Hall, Lambe, No. 413.
    crassa Rominger, Lambe, No. 413.
    cryptodens Billings (sp.), Lambe, No. 413.
    fischeri Billings (sp.), Lambe, No. 413.
    frondosa Nicholson (sp.), Lambe, No. 413.
    labiosa Billings, Lambe, No. 413.
    lichenoides Rominger, Lambe, No. 413.
    multipora Hall, Lambe, No. 413.
    roemeri Billings (sp.), Lambe, No. 413.
    turgida Rominger, Lambe, No. 413.
    sp., Girty, No. 223.
Clathrospongia Hall, Hall and Clarke, Nos. 275, 276.
    abacus Hall, Hall and Clarke, Nos. 275, 277.
    caprodonta n. sp., Hall and Clarke, Nos. 275, 277.
    (?) desmia n. sp., Hall and Clarke, Nos. 275, 276.
    fenestrata Hall (sp.), Hall and Clarke, Nos. 275, 276.
    (?) hamiltonensis Hall (sp.), Hall and Clarke, Nos. 275, 276.
    (?) irregularis Hall (sp.), Hall and Clarke, Nos. 275, 276.
    (?) tomaculum Hall (sp.), Hall and Clarke, Nos. 275, 276.
    vascellum Hall (sp.), Hall and Clarke, Nos. 275, 276.
Clavilithes kennedyanus Har., Harris, No. 281.
Clemmys insculpta Le Conte, Cope, No. 118.
    percrassus Cope, Cope, No. 118.
Cleodictya Hall, Hall and Clarke, Nos. 275, 277.
    claypolei n. sp., Hall and Clarke, Nos. 275, 277.
    gloriosa Hall, Hall and Clarke, Nos. 275. 277.
    mohri Hall, Hall and Clarke, Nos. 275, 277.
Clepsydrospongia matutina n. sp., Hall and Clarke, Nos. 275, 276.
Cliothyris crassicardinalis White, Girty, No. 223.
        var. nana n. var., Girty, No. 223.
    roissyi Walcott (non Léveillé), Girty, No. 223.
Clisiophyllum billingsi Dawson sp., Lambe, No. 414.
    teres, n. sp., Girty, No. 223.
Clypeaster? brewerianus Rémond, Merriam. No. 480.
Cœnites Eichwald, Lambe, No. 413.
    juniperina Eichwald, Lambe, No. 413.
    lunata Nicholson and Hinde, Lambe, No. 413.
    selwynii Nicholson (sp.), Lambe, No. 413.
Coleolus Hall, Grabau, No. 229.
    (?) gracilis Hall, Grabau, No. 229.
    tenuicinctum, Grabau, No. 229.
Columnaria rugosa Billings sp., Lambe, No. 414.
Conocardium Bronn, Grabau, No. 229.
    crassifrons (Conrad), Grabau, No. 229.
    eboraceum Hall, Grabau, No. 229.

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- *Genera and species described*—Continued.
  - Conocardium—Continued.
    - normale Hall, Grabau, No. 229.
    - pulchellum White and Whitfield (?), Girty, No. 223.
  - Conomitra tracyi n. sp., Harris, No. 281.
  - Conostichus broadheadi Lx., White, No. 720.
    - prolifer Lx., White, No. 720.
  - Conularia Miller, Grabau, No. 229.
    - undulata Conrad, Grabau, No. 229.
  - Corbula alabamensis var., Harris, No. 280.
    - sp., Logan, No. 440.
  - Cordaites Unger, White, No. 720.
    - communis Lx., White, No. 720.
    - diversifolius Lx. ?, White, No. 720.
  - Cordianthus dichotomus Lx., White, No. 720.
    - ovatus Lx., White, No. 720.
  - Cornulina armigera, Harris, No. 281.
  - Cornulites Schlotheim, Grabau, No. 229.
    - hamiltoniæ n. sp., Grabau, No. 229.
  - Cornus newberryi Hollick, Knowlton, No. 392.
    - wrightii n. sp., Knowlton, No. 392.
    - studeri Heer (?), Hollick, No. 328.
  - Corylus macquarryi (Forbes) Heer, Knowlton, No. 392.
  - Crania Retzius, Grabau, No. 229.
    - crenistriata Hall, Grabau, No. 229.
    - lævis Keyes, Girty, No. 223.
  - Craniella Oehlert, Grabau, No. 229.
    - hamiltoniæ Hall, Grabau, No. 229.
  - Craspedophyllum Dybowsky, Grabau, No. 229.
    - archiaci Billings, Grabau, No. 229.
    - subcæspitosum (Nicholson), Grabau, No. 229.
  - Crassatella vadosa Mort., Harris, No. 280.
    - sp., Harris, No. 280.
  - Credneria ? pachyphylla n. sp., Knowlton, No. 392.
  - Crenipecten lævis n. sp., Weller, No. 711.
    - winchelli (Meek)?, Weller, No. 711.
  - Crepicephalus Owen, Walcott, No. 682.
    - texanus Shumard sp., Walcott, No. 682.
  - Cryphæus Green, Grabau, No. 229.
    - boothi Green, Grabau, No. 229.
      - var. calliteles Green, Grabau, No. 229.
  - Cryptocarya eolignitica n. sp., Hollick, No. 328.
  - Cryptodictya Hall, Hall and Clarke, Nos. 275, 276.
    - alleni Hall, Hall and Clarke, Nos. 275, 276.
  - Cryptonella Hall, Grabau, No. 229.
    - planirostris Hall, Grabau, No. 229.
    - rectirostris Hall, Grabau, No. 229.
  - Cryptozoon ? occidentale Dawson, Walcott, No. 681.
  - Chuaria circularis n. gen., et sp., Walcott, No. 681.
  - Ctenobolbina Ulrich, Grabau, No. 229.
    - minima Ulrich, Grabau, No. 229.
  - Cucullæa haguei Meek, Stanton, No. 603.
  - Cyathophyllum Goldfuss, Grabau, No. 229.
    - anticostiense Billings, Lambe, No. 414.
    - articulatum Wahlenberg, Lambe, No. 414.
    - cæspitosum Goldfuss (?), Girty, No. 223.
    - conatum Hall, Grabau, No. 229.
    - dawsoni n. sp., Lambe, No. 414.
    - spenceri n. sp., Lambe, No. 414.

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- *Genera and species described*—Contin
  - Cycadeoidea Buckland, Ward, No.
    - aspera n. sp., Ward, Nos. 690, 69
    - colei n. sp., Ward, Nos. 690, 691.
    - colossalis n. sp., Ward, Nos. 690,
    - cicatricula n. sp., Ward, Nos. 69
    - dacotensis (McBride) Ward em Nos. 690, 691.
    - excelsa n. sp., Ward, Nos. 690, 6
    - formosa n. sp., Ward, Nos. 690, 6
    - furcata n. sp., Ward, Nos. 690, 6
    - ingens n. sp., Ward, Nos. 690, 69
    - ingens Ward, Wieland, Nos. 73
    - insolita n. sp., Ward, Nos. 690, 6
    - jenneyana Ward, Ward, Nos. 69
    - marshiana n. sp., Ward, Nos. 69
    - mcbridei n. sp., Ward, Nos. 690,
    - minnekahtensis n. sp., Ward, N
    - nana n. sp., Ward, Nos. 690, 691.
    - occidentalis n. sp., Ward, Nos. 6
    - paynei n. sp., Ward, Nos. 690, 69
    - pulcherrima n. sp., Ward, Nos.
    - stillwelli n. sp., Ward, Nos. 690,
    - turrita n. sp., Ward, Nos. 690, 69
    - wellsi n. sp., Ward, Nos. 690, 691
    - wielandi n. sp., Ward, No. 690.
  - Cycadeosperum rotundatum Fontaine, No. 188.
  - Cyclocladia Lindley and Hutton, 720.
    - brittsii n. sp., White, No. 720.
  - Cyclostrema aldrichi n. sp., Harris,
  - Cylichna aldrichi Lang., Harris, N
    - sylværupus n. sp., Harris, No. 2
  - Cyllene bellana Har., Harris, No. 2
  - Cyperacites giganteus n. sp., Kno 392.
    - (?) sp., Knowlton, No. 392.
  - Cyperites sp., Hollick, No. 328.
  - Cyphaspis Burmeister, Grabau, No
    - ornata Hall, Grabau, No. 229.
  - Cypræa smithii Ald., Harris, No. 28
  - Cypricardella Hall, Grabau, No. 22
    - bellistriata (Conrad), Grabau,
  - Cypricardia ? haguei n. sp., Stanto
  - Cypricardinia Hall ?, Grabau, No.
    - indenta (Conrad), Grabau, No.
  - Cyprina ? cinnabarensis n. sp., Stan
    - (?) iddingsi n. sp., Stanton, No.
  - Cyrtina Davidson, Grabau, No. 229.
    - hamiltonensis Hall, Grabau, N
      - var. recta Hall, Grabau, No
  - Cyrtoclymenia neapolitana Clar No. 96.
  - Cystiphyllum Lonsdale, Grabau, N
    - aggregatum Billings, Lambe, N
    - americanum E. and H., Grabau
    - conifollis Hall, Grabau, No. 229
    - niagarense Hall sp., Lambe, No
    - varians Hall, Grabau, No. 229.
    - vesiculosum Goldfuss sp., Lam
  - Cytheria (?) newcombei, Merriam,
    - vancouverensis, Merriam, No.
  - Czekanowskia nervosa Heer, For 188.
  - Dalmanella subcarinata Hall, Girt

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d *species described*—Continued.
ites pleuroptyx (Green), Girty, No.
gene kanii (?) Heer, Hollick, No. 328.
on Leidy, Hay, No. 289.
cis cantabridgiensis n. sp., Vaughan,
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um microstria Heilp., Harris, No. 281.
tannulatum Ald., Harris, No. 281.
loides Con., Harris, No. 281.
keokuk Hall (?), Girty, No. 223.
a ? montana n. sp., Knowlton, No. 392.
nus Hall, Walcott, No. 682.
us M. and H. sp., Walcott, No. 682.
phyllum ? sp., White, No. 720.
teris carrii (Lx.), White, No. 719.
ersonensis D. W., White, No. 719.
pongia n. gen., Hall and Clarke, Nos.
5, 276.
ondensis n. sp., Hall and Clarke, Nos.
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acteria n. sp., Hall and Clarke, Nos.
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ria n. sp., Hall and Clarke, Nos. 275,
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ndrica Whitfield (sp.), Hall and Clarke,
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orphia n. sp., Hall and Clarke, Nos.
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lea n. sp., Hall and Clarke, Nos. 275,
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aura n. sp., Hall and Clarke, Nos. 275,
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arcellia Clarke (sp.), Hall and Clarke,
os. 275, 276.
ini Barrois (sp.), Hall and Clarke, Nos.
5, 276.
trum Hall (sp.), Hall and Clarke, Nos.
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a n. sp., Hall and Clarke, Nos. 275,
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stylina n. sp., Hall and Clarke, Nos.
5, 277.
stodictya) osculada n. sp., Hall and
arke, Nos. 275, 277.
a King, Grabau, No. 229.
a Hall and Whitfield, Girty, No. 223.
, Weller, No. 711.
nsæna) romingeri Hall, Grabau, No.
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os haguei n. sp., Knowlton, No. 392.
arensis n. sp., Knowlton, No. 392.
hyllum cæspitosum Hall sp., Lambe,
o. 414.
ticaule Hall sp., Lambe, No. 414.
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cus longus, Osborn, No. 509.
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o. 672.
erticostata n. sp., Vaughan, No. 672.
var. columnaria n. var., Vaughan, No. 672.

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Dipterus calvini Eastman, Udden, No. 644.
 contraversus, Hay, No. 286.
Discohelix verrili n. sp. (by Aldrich), Harris, No. 281.
Distyonema Hall, Grabau, No. 229.
Dombeyopsis platanoides Lx., Knowlton, No. 392.
Dorycrinus Roemer, Grabau, No. 229.
Dryophyllum longipetillatum n. sp., Knowlton, No. 392.
Dryopteris weedii n. sp., Knowlton, No. 392.
 xantholithense n. sp., Knowlton, No. 392.
Dryptosaurus kenabekides, Hay, No. 289.
Duncanella fanningana (Safford), Girty, No. 222.
 rudis Girty, Girty, No. 222.
Eccyliomphalus Portloch, Grabau, No. 229.
 laxus (Hall), Grabau, No. 229.
Echinarachinius gibbsi Rémond, Merriam, No. 480.
 excentricus Eschscholtz, Merriam, No. 480.
 (?) ectenodictya Hall, Hall and Clarke, Nos. 275, 277.
 implexa Hall, Hall and Clarke, Nos. 275, 277.
Edmondia burlingtonensis M. and W., Weller, No. 711.
 missouriensis n. sp., Weller, No. 711.
 ? reflexa Meek, Girty, No. 222.
 subtruncata Meek ?, Girty, No. 222.
Elæodendron polymorpha Ward, Knowlton, No. 392.
Elymella Hall, Grabau, No. 229.
 missouriensis Miller and Gurley, Weller, No. 711.
 nuculloides Hall, Grabau, No. 229.
Empo lisbonensis n. sp., Stewart, No. 610.
Endothyra baileyi var. parva n. var., Girty, No. 223.
Entomis Jones, Grabau, No. 229.
 rhomboidea Jones, Grabau, No. 229.
Equisetum canaliculatum n. sp., Knowlton, No. 392.
 deciduum n. sp., Knowlton, No. 392.
 haguei n. sp., Knowlton, No. 392.
 lesquereuxii Kn. Knowlton, No. 392.
 virginicum Fontaine, Fontaine, No. 188
Equus Linn, Cope, No. 118.
 fraternus Leidy, Cope, No. 118.
 phlegon, Hay, No. 289.
Eremopteris bolibata n. sp., White, No. 720.
 missouriensis Lx., White, No. 720.
Eridopora (?) sp., Girty, No. 223.
Erisocrinus megalobrachus n. sp., Beede, No. 44.
Erithizon ? dorsatum Linn, Cope, No. 118.
Eryops Cope, Williston, No. 750.
Eulima exilis Gabb, Harris, No. 281.
 (Subularia) cainei n. sp., Harris, No. 281.
Eulimella tenua Gabb, Harris, No. 281.
Eumetria verneuiliana Hall, Girty, No. 223.
Euomphalus n. sp., Girty, No. 222.

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Genera and species described—Continued.
Eupachycrinus tuberculatus Meek and Worthen, Girty, No. 222.
sp., Girty, No. 222.
Euphemus, Girty, No. 222.
(?) sp., Weller, No. 711.
Euthria dubia Ald., Harris, No. 281.
Excipulites callipterides (Schimp.) Kidst., White, No. 720.
Exilia pergracilis Harris, No. 281.
Exogyra costata Say, Harris, No. 280.
Fagus undulata n. sp., Knowlton, No. 392.
Fasciolaris sp., Logan, No. 438.
Favosites Lamarck, Grabau, No. 229.
Favosites Lamarck, Lambe, No. 413.
alpenensis, Lambe, No. 413.
argus Hall, Grabau, No. 229.
aspera d'Orbigny, Lambe, No. 413.
basaltica Goldfuss (sp.), Lambe, No. 413.
billingsii Rominger, Lambe, No. 413.
canadensis Billings (sp.), Lambe, No. 413.
cervicornis Milne-Edwards and Haime, Lambe, No. 413.
clausa Rominger, Lambe, No. 413.
conicus Hall, Girty, No. 222.
digitata Rominger, Lambe, No. 413,
gaspensis n. sp., Lambe, No. 413.
gothlandica Lamarck, Lambe, No. 413.
hamiltoniæ Hall, Grabau, No. 229.
hemispherica Milne-Edwards and Haime, Lambe, No. 413.
hisingeri Milne-Edwards and Haime, Lambe, No. 413.
niagarensis Hall, Lambe, No. 413.
nitella Winchell, Lambe, No. 413.
radiciformis Rominger, Lambe, No. 413
turbinata Billings, Lambe, No. 413.
sp., Girty, No. 223.
Feistmantelia oblonga Ward, n. sp., Fontaine, No. 188.
Felis eyra Desm., Cope, No. 118.
Fenestella Lonsdale, Girty, No. 223.
Fenestella Miller, Grabau, No. 229.
emaciata Hall, Grabau, No. 229.
planiramosa Hall, Grabau, No. 229.
Ficophyllum serratum Fontaine, Fontaine, No. 188.
Ficus artocarpoides ? Lx., Hollick, No. 328.
deformata n. sp., Knowlton, No. 392.
densifolia n. sp., Knowlton, No. 392.
haguei n. sp., Knowlton, No. 392.
harrisiana n. sp., Hollick, No. 328.
planicostata Lx., Hollick, No. 328.
ungeri Lx., Knowlton, No. 392.
sp., Knowlton, No. 392.
Fissurella alabama n. sp., Harris, No. 281.
Fistulicella Simpson, Grabau, No. 229.
plana Hall, Grabau, No. 229.
Fistuliporina Simpson, Grabau, No. 229.
digitata (Hall), Grabau, No. 229.
micropora (Hall), Grabau, No. 229.
minuta (Rominger), Grabau, No. 229.
scrobitulata (Hall), Grabau, No. 229.
segregata (Hall), Grabau, No. 229.

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Genera and species described—Contin
Fletcheria Milne-Edwards and Ha
No. 413.
incerta Billings (sp.), Lambe,
Fraxinus denticulata Heer, Kn
392.
johnstrupi (?) Heer, Hollick, N
wrightii n. sp., Knowlton, No.
Fulguroficus triserialis Whitf., Ha
Fusoficula juvenis Whitf., Harris,
Fusulina cylindrica, Smith, No. 5
Fusus bellanus Har., Harris, No. 2
harrisi Ald., Harris, No. 280.
interstriatus Heilp., Harris, N
ottonis Ald., Harris, No. 281.
rugatus Ald., Harris, No. 281.
subtenuis Heilp., Harris, No. 2
sp., Logan, No. 438.
(Buccinofusus) harrisi Ald., Ha
Geinitzia jenneyi n. sp., Fontaine,
Gennæocrinus W. and S., Grabau,
eucharis (Hall), Grabau, No. 2
nyssa (Hall), Grabau, No. 229.
Gephyroceras Hyatt, Clarke, No. 9
perlatum Hall (sp.), Clarke, N
(?) (Probeloceras?) gunende
Clarke, No. 96.
Glauconome Goldfuss, Grabau, No
carinata Hall, Grabau, No. 229
Gleichenia zippei (Corda) Heer?,
No. 188.
Glossozamites fontaineanus Ward
taine, No. 188.
Glyptostrobus brookensis (Fonta
Fontaine, No. 188.
Gomphoceras Sowerby, Grabau, N
lunatum Hall, Grabau, No. 22
manes Hall, Grabau, No. 229.
Gongylospongia n. gen., Hall a
No. 275, 276.
complanatus Hall, Grabau, No
marshi n. sp., Hall and Clarke,
rhynchostoma Clarke, Grabau
sororium Clarke, Grabau, No.
Goniatites de Haan, Grabau, No. 2
(Gephyroceras) holzapfeli C
bau, No. 229.
(Mantioceras) intumescens Be
bau, No. 229.
(Probeloceras) lutheri Grabau
(Tornoceras) bicostatus Hal
No. 229.
uniangularis Conrad, Grab
Goniobasis? (?) increbescens n. sp
No. 603.
pealei n. sp., Stanton, No. 603.
Goniophora Phillips, Grabau, No.
modiomorphoides n. sp., Grab
230.
Gosselettia Barrios, Grabau, No. 2
retusa Hall, Grabau, No. 229.
Grammatodon M. and H., Woods,
Grammysia de Verneuil, Grabau,
arcuata (Conrad), Grabau, No.

gy—Continued.
d species described—Continued.
psis ? aldersoni n. sp., Knowlton, No.

dictya n. gen., Hall and Clarke, Nos.
5, 277.
hanes n. sp., Hall and Clarke, Nos. 275,
7.
a galceola var. nebrascensis Meek and
ayden, Stanton, No. 608.
noconvexa Whitfield, Stanton, No. 608.
icularis Lam., Harris, No. 280.
on, Hay, No. 286.
cus Linn, Cope, No. 118.
rinus d'Orb., Grabau, No. 229.
tadactylus n. sp., Grabau, No. 229.
nus schucherti n. sp., Hay, No. 287.
hyllum, E. and H., Grabau, No. 229.
di n. sp., Grabau, No. 229.
n. gen., Walcott, No. 682.
erica n. sp., Walcott, No. 682.
ctya n. gen., Hall and Clarke, Nos. 275,
6.
oniana n. sp., Hall and Clarke, Nos.
5, 276.
nsis n. sp., Hall and Clarke, Nos. 275,
6.
es Fischer, Lambe, No. 413.
nularia L., Lambe, No. 413.
var. amplitubulata n. var., Lambe,
No. 413.
var. gracilis Hall, Lambe, No. 413.
var. nitida n. var., Lambe, No. 413.
var. quebecensis n. var., Lambe, No.
413.
var. simplex n. var., Lambe, No. 413.
pacta Rominger, Lambe, No. 413.
ropora Whitfield, Lambe, No. 413.
lla Hall, Grabau, No. 229.
adensis (Nicholson), Grabau, No. 229.
ormis (Billings), Grabau, No. 229.
ictya n. gen., Hall and Clarke, Nos.
5, 276.
concordia n. sp., Hall and Clarke, Nos.
5, 276.
cio n. sp., Hall and Clarke, Nos. 275,
6.
ania n. sp., Hall and Clarke, Nos. 275,
6.
es Dana, Lambe, No. 413.
dinata Lonsdale (sp.), Lambe, No.
3.
rstincta L., Lambe, No. 413.
tubulata McCoy (sp.), Lambe, No. 413.
yllum Hall, Grabau, No. 229.
fluens Hall, Grabau, No. 229.
i, E. and H. Grabau, No. 229.
thoidichnites meeki n. sp., Walcott,
o. 681.
neihartensis n. sp., Walcott, No. 681.
spiralis n. sp., Walcott, No. 681.
s wortheni, Hay, No. 286.
eras sp., Harris, No. 280.
crescentia n. sp., Knowlton, No. 392.
veri n. sp., Knowlton, No. 392.
sphæroidalis Duncan, Girty, No. 222.

Paleontology—Continued.
Genera and species described—Continued.
Hipponyx sylværupis n. sp., Harris, No. 281.
Holasterella wrighti var. americana n. var., Girty, No. 223.
Homalonotus Kœnig, Grabau, No. 229.
  dekayi (Green), Grabau, No. 229.
Homomya gallatinensis n. sp., Stanton, No. 608.
Hybodus copei, Hay, No. 286.
Hydnoceras Conrad, Hall and Clarke, Nos. 275, 276.
  anthracis n. sp., Hall and Clarke, Nos. 275, 276.
  avoca n. sp., Hall and Clarke, Nos. 275, 276.
  barroisi nom. nov., Hall and Clarke, Nos. 275, 276.
  bathense n. sp., Hall and Clarke, Nos. 275, 276.
  botrœdema n. sp., Hall and Clarke, Nos. 275, 276.
  eumeces n. sp., Hall and Clarke, Nos. 275, 276.
  eutheles n. sp., Hall and Clarke, Nos. 275, 276.
  gracile n. sp., Hall and Clarke, Nos. 275, 276.
  hyastrum n. sp., Hall and Clarke, Nos. 275, 276.
  jeumontense n. sp., Hall and Clarke, Nos. 275, 276.
  legatum, Hall and Clarke, Nos. 275, 276.
  lutheri n. sp., Hall and Clarke, Nos. 275, 276.
  multinodosum n. sp., Hall and Clarke, Nos. 275, 276.
  nodosum Hall (sp.), Hall and Clarke, Nos. 275, 276.
  phymatodes n. sp., Hall and Clarke, Nos. 275, 276.
  rhopalum n. sp., Hall and Clarke, Nos. 275, 276.
  tuberosum Conrad, Hall and Clarke, Nos. 275, 276.
    var. glossema n. var., Hall and Clarke, Nos. 275, 276.
  variabile n. sp., Hall and Clarke, Nos. 275, 276.
Hydriodictya n. gen., Hall and Clarke, Nos. 275, 276.
  cylix n. sp., Hall and Clarke, Nos. 275, 276.
  nephelia n. sp., Hall and Clarke, Nos. 275, 276.
  patula Hall, Hall and Clarke, Nos. 275, 276.
Hyolithes primordialis Hall, Walcott, No. 682.
Hyomeryx Marsh, Scott, No. 576.
Hypertragulus Cope, Scott, No. 576.
Hyphantænia Vanuxem (emendata), Hall and Clarke, Nos. 275, 276.
  chemungensis Vanuxem, Hall and Clarke, Nos. 275, 276.
Hysterites cordaitis Gr. 'Ey., White, No. 720.
Icanodus ? limitaris, Hay, No. 286.
Ilex ? affinis (?) Lx., Hollick, No. 328.
  sp., Hollick, No. 328.

Paleontology—Continued.
Genera and species described—Continued.
Inoceramus acuteplicatus n. sp., Stanton, No. 608.
barabini Mort., Harris, No. 280.
Iphidea sculptis Meek, Walcott, No. 682.
sp. undet., Walcott, No. 682.
Isochilina Jones, Grabau, No. 229.
fabacea Jones, Grabau, No. 229.
Isopholis, Hay, No. 286.
Juglans crescentia n. sp., Knowlton, No. 392.
laurifolia n. sp., Knowlton, No. 392.
rugosa Lx., Hollick, No. 328.
schimperi Lx., Hollick, No. 328.
Kellia prima Ald., Harris, No. 280.
Labechus huronensis Billings sp., Lambe, No. 416.
Lælaps incrassatus, Hay, No. 289.
Lagomys palatinus Cope, Cope, No. 118.
Lapparia dumosa Con. var., Harris, No. 281.
Latirus tortilis var. nanafalius n. var., Harris, No. 281.
Laurinoxylon pulchrum n. sp., Knowlton, No. 392.
Laurus grandis Lx., Knowlton, No. 392.
montana n. sp., Knowlton, No. 392.
perdita n. sp., Knowlton, No. 392.
princeps Heer., Knowlton, No. 392.
primigenia Ung., Hollick, No. 328.
primigenia? Ung., Knowlton, No. 392.
pseudo-carolinensis Lx., Knowlton, No. 392.
Laxispira imbricalis, Harris, No. 280.
Lebedictya n. gen., Hall and Clarke, Nos. 275, 277.
crinita n. sp., Hall and Clarke, Nos. 275, 277.
Leda aldrichiana Har. var., Harris, No. 280.
corpulentoides Ald. var., Harris, No. 280.
Legumen planulatum Con., Harris, No. 280.
Leguminosites lamarensis n. sp., Knowlton, No. 392.
lesquereuxiana Kn., Knowlton, No. 392.
Leiopteria Hall, Grabau, No. 229.
conradi Hall, Grabau, No. 229.
rafinesquii Hall, Grabau, No. 229.
Leiorhynchus Hall, Grabau, No. 229.
dubium Hall, Grabau, No. 229.
limitare (Vanuxem), Grabau, No. 229.
multicostus Hall, Grabau, No. 229.
quadricostatum (Vanuxem), Grabau, No. 229.
Leiostoma (?) ludoviciana n. sp., Harris, No. 280.
Leperditia Ronault, Grabau, No. 229.
hudsonica Hall, Grabau, No. 229.
Lepidocystis vesicularis Lx., White, No. 719.
Lepidodendron Sternberg, White, No. 720.
brittsii Lx., White, No. 720.
choctavense n. sp., White, No. 719.
clypeatum Lx., White, No. 720.
lanceolatum Lx., White, No. 720.
modulatum Lx., White, No. 719.
rimosum var. recorticatum n. var., White, No. 720.
scutatum Lx., White, No. 720.

Paleontology—Continued.
Genera and species described—Continued.
Lepidophloios Sternberg, White, No. 720
van ingeni n. sp., White, No. 720.
(?) cf. van ingeni, White, No. 720.
Lepidophyllum brevifolium Lx., White, No. 719.
jenneyi n. sp., White, No. 720.
lanceolatum L. and H., White, No. 719.
cf. mansfieldi Lx., White, No. 719.
missouriense n. sp., White, No. 720.
truncatum Lx., White, No. 719.
Lepidostrobus princeps Lx., White, No. 720.
Lepidoxylon anomalum Lx., White, No. 720.
Leptæna rhomboidalis Wilkens, Girty, Nos. 222, 223.
Leptecodon rectus n. gen. et sp., Williston, No. 748.
Leptichthys n. gen., Stewart, No. 612.
agilis n. sp., Stewart, No. 612.
Leptomeryx Leidy, Scott, No. 576.
Leptophyllia agassizi n. sp., Vaughan, No. 672.
Leptoreodon Wortman, Scott, No. 576.
Leptostrobus (?) alatus Ward n. sp., Fontaine, No. 188.
longifolius Fontaine, Fontaine, No. 188.
Leptotragulus Scott and Osborn, Scott, No. 576.
Lepus sylvaticus Bachm., Cope, No. 118.
Levibuccinum lineatum Con., Harris, No. 281.
Levifusus indentus n. sp., Harris, Nos. 280, 281.
pagoda Heilp., Harris, Nos. 280, 281.
supraplanus n. sp., Harris, Nos. 280, 281.
trabeatus Con., Harris, No. 281.
trabeatus Con. var.?, Harris, No. 280.
Lichenalia Hall, Grabau, No. 229.
stellata Hall, Grabau, No. 229.
Lichenaria typa W. and S., Sardeson, No. 567.
Lima pelagica Mort., Harris, No. 280.
Limnocyon riparius, Marsh, No. 464.
Linearia metastriata, Harris, No. 280.
Lingula Bruguière, Grabau, No. 229.
delia Hall, Grabau, No. 229.
mytiloides Sowerby?, Girty, No. 222.
spatulata Vanuxem, Grabau, No. 229.
(Glossina) leana Hall, Grabau, No. 229.
Lingulella subgenus of Obolus, Walcott, No. 683.
Linopteris gilkersonensis n. sp., White, No. 720.
Liorhynchus haguei n. sp., Girty, No. 223.
Liostracus parvus n. sp., Walcott, No. 682.
Liotia granulata Lea, Harris, No. 281.
Lithostrotion macounii n. sp., Lambe, No. 414.
sp., Girty, No. 223.
Litsea cuneata n. sp., Knowlton, No. 392.
Loculipora Hall, Grabau, No. 229.
perforata Hall, Grabau, No. 229.
Lonsdaleia pictoense Billings sp., Lambe, No. 414.
Loxonema Phillips, Grabau, No. 229.
attenuatum Hall?, Girty, No. 222.
breviculum Hall, Grabau, No. 229.
? coapta Hall, Grabau, No. 229.
delicatum n. sp., Girty, No. 223.
delphicola Hall, Grabau, No. 229.
hamiltoniæ Hall, Grabau, No. 229.

gy—Continued.
d *species described*—Continued.
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p., Girty, No. 223.
Weller, No. 711.
ozarkana Har., Harris, No. 280.
ardium Munster, Grabau, No. 229.
um Hall, Grabau, No. 229.
ile Hall, Grabau, No. 229.
hoadsii Cope, Cope, No. 118.
Milne-Edwards and Haime, Lambe, o. 413.
is Billings, Lambe, No. 413.
ricana Milne-Edwards and Haime, ambe, No. 413.
ipiens Rominger, Lambe, No. 413.
gua Billings (sp.), Lambe, No. 413.
erba Billings, Lambe, No. 413.
m kaulfusii Heer, Knowlton, No. 2.
lcaratus Cope, Cope, No. 118.
Nich. and Eth. jun., Lambe, No. 413.
lfussi Billings (sp.), Lambe, No. 413.
tya Hall, Hall and Clarke, Nos. 275, 7.
burlingtonensis Hall (sp.), Hall and arke, Nos. 275, 277.
ingeri Hall, Hall and Clarke, Nos. 5, 277.
nella Girty, Hall and Clarke, Nos. 275, 6.
odus Kaupp, Cope, No. 118.
cilis Cope, Cope, No. 118.
on Lycett, Grabau, No 229.
on Lycett, Woods, No. 793.
iltoniæ Hall, Grabau, No. 229.
Weller, No. 711.
philadelphicus n. sp., Harris, No. 281.
bistriata Har., Harris, No. 280.
ia culveri n. sp. Knowlton, No. 392.
ardiana Lx., Hollick, No. 328.
ceolata Lx., Hollick, No. 328.
rophylla n. sp., Knowlton, No. 392.
pollardi n. sp., Knowlton, No. 392.
ctabilis n. sp., Knowlton, No. 392.
enna lamarensis n. sp., Knowlton, No. 2.
ceras accelerans n. sp., Clarke, No. 96.
rimatum n. sp., Clarke, No. 96.
tractum n. sp., Clarke, No. 96.
ciculatum n. sp., Clarke, No. 96.
ifer Clarke, Clarke, No. 96.
n. sp., Clarke, No. 96.
tersoni Hall (sp.), Clarke, No. 96.
var. styliophilum, n. var., Clarke, No. 96.
nchostoma n. sp., Clarke, No. 96.
ulator Hall (sp.), Clarke, No. 96.
orium n. sp., Clarke, No. 96.
lum n. sp., Clarke, No. 96.
ans n. sp., Clarke, No. 96.
teris capitata n. sp., White, No. 719.
ricata (Schloth) Zeill., White, No. 719.
nervosa (Brongn.) Zeill., White, No. 0.
identalis n. sp., White, No. 719.
villosa n. var., White, No. 719.
imanni (Brongn.), White, No, 719.

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Genera and species described—Continued.
Mariopteris—Continued.
  sphenopteroides (Lx.) Zeill., White, No. 720.
  sp., White, No. 720.
  n. sp., ? White, No. 720.
Martinia rostrata n. sp., Girty, No. 223.
Mastodon americanus Leidy, Cope, No. 118.
Mathilda leana Ald., Harris, No. 281.
Matonidium althausii (Dunker) Ward n. comb., Fontaine, No. 188.
Mazzalina plena Ald., Harris, No. 280.
  var. plenus, Harris, No. 281.
Megalichthys, Hay, No. 286.
Megalonyx loxodon Cope, Cope, No. 118.
  scalper Cope, Cope, No. 118.
  tortulus Cope, Cope, No. 118.
  wheatleyi Cope, Cope, No. 118.
Megambonia lata Hall, Girty, No. 222.
Melania sylværupis n. sp., Harris, No. 281.
  trigemmata Con., Harris, No. 281.
Melanopsis anita Ald., Harris, No. 281.
  planoidea Ald., Harris, No. 281.
Menophyllum (?) excavatum n. sp., Girty, No. 223.
Mephitis Linn., Cope, No. 118.
  fossidens Cope, Cope, No. 118.
  leptops Cope, Cope, No. 118.
  obtusatus Cope, Cope, No. 118.
  orthostichus Cope, Cope, No. 118.
Meristella Hall, Grabau, No. 229.
  arcuata var. atoka n. var., Girty, No. 222.
  barrisi Hall, Grabau, No. 229.
  haskinsi Hall, Grabau, No. 229.
  rostrata Hall, Grabau, No. 229.
Mesalia pumila var. alabamensis Whitf., Harris, No. 281.
Mesogaulus ballensis n. gen et sp., Riggs, No. 550.
Mesomorpha catadupensis n. sp., Vaughan, No. 672.
Matadoxides magnificus n. sp., Matthew, No. 470.
Metula sylværupis n. sp., Harris, No. 281.
Michelinia de Koninck, Lambe, No. 413.
  clappii Milne-Edwards and Haime, Lambe, No. 413.
  convexa d'Orbigny, Lambe, No. 413.
  favosistoidea Billings em. (favosoidea), Lambe, No. 413.
  placenta White, Girty, No. 223.
Micmacca van ingeni Matt., Matthew, No. 468.
Microtus dideltus Cope, Cope, No. 118.
  diluvianus Cope, Cope, No. 118.
  involutus Cope, Cope, No. 118.
  speothen Cope, Cope, No. 118.
Mitra hatchetigbeensis Ald., Harris, No. 281.
  pergracilis Con., Harris, No. 281.
Mitrella alabamensis Ald. and M., Harris, No. 281.
  mississippiensis Ald., Harris, No. 281.
Modiella Hall, Grabau, No. 229.
Modiola alabamensis Ald., Harris, No. 280.
  pygmæa (Conrad), Grabau, No. 229.
  stubbsi n. sp., Harris, No. 280.
  sp., Logan, No. 440.

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Genera and species described—Continued.
Modiomorpha Hall, Grabau, No. 229.
alata (Conrad), Grabau, No. 229.
concentrica (Conrad), Grabau, No. 229.
northviewensis n. sp., Weller, No. 711.
subalata (Conrad), Grabau, No. 229.
Monilopora Nich. and Eth. jr., Grabau, No. 231.
antiqua Whiteaves, Grabau, No. 231.
beecheri n. sp., Grabau, No. 231.
crassa (McCoy), Grabau, No. 231.
Moniloporidæ n. fam, Grabau, No. 341.
Monopteria ? subalata n. sp., Beede and Rogers, No. 46.
Monotrypa Nicholson, Grabau, No. 229.
amplectens n. sp., Grabau, No. 229.
fructicosa (Hall), Grabau, No. 229.
(?) furcata (Hall), Grabau, No. 229.
Moorea Jones and Kirby, Grabau, No. 229.
bicornuta Ulrich, Grabau, No. 229.
Mourlonia northviewensis n. sp., Weller, No. 711.
Multicolumnastræa n. gen., Vaughan, No. 672.
cyathiformis (Duncan), Vaughan, No. 672.
Murchisonia marcouiana Geinitz, Girty, No. 222.
Muricidea imbricatula, Harris, No. 281.
Musophyllum complicatum Lx., Knowlton, No. 392.
Mustela diluviana Cope, Cope, No. 118.
Myalina ? exasperata n. sp., Beede, No. 44.
Myliobatis leidyi, Hay, No. 286.
Mylodon ? harlanii Owen, Cope, No. 118.
Mylohyus Cope, Cope, No. 118.
nasutus Leidy, Cope, No. 118.
pennsylvanicus Leidy, Cope, No. 118.
tetragonus Cope, Cope, No. 118.
Myrica bolanderi ? Lx., Knowlton, No. 392.
lamarensis n. sp., Knowlton, No. 392.
wardii n. sp., Knowlton, No. 392.
Nageiopsis angustifolia Fontaine ?, Fontaine, No. 188.
longifolia Fontaine, Fontaine, No. 188.
Nassa cancellata Lea, Harris, No. 281.
exilis Con., Harris, No. 280.
newcombei Merriam, Merriam, No. 481.
Natica alabamiensis, Harris, No. 280.
aperta Whitf., Harris, Nos. 280, 281.
eminula Har., Harris, No. 280.
eminula Har. var., Harris, No. 281.
magno-umbilicata Lea, Harris, No. 281.
(Neverita) onusta Whitf., Harris, No. 281.
(Lacunaria) alabamiensis Whitf., Harris, No. 281.
erecta Whitf., Harris, No. 281.
semilunata, Harris, No. 281.
(Sigaticus) clarkeana Ald., Harris, No. 281.
Naticopsis (?) sp., Girty, No. 223.
Nautilus Breynius, Grabau, No. 229.
magister Hall, Grabau, No. 229.
(Centroceras) marcellensis (Vanuxem), Grabau, No. 229.
Neithea quinquecostata ? (Sow.) Mort., Harris, No. 280.
Neritina wyomingensis n. sp., Stanton, No. 603.

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Genera and species described—Continued.
Neuropteris Brongniart, 1822, White, No. 720.
caudata D. W., White, No. 719.
dilatata (L. and H.) Lx., White, No. 720.
griffithii Lx., White, No. 719.
harrisi n. sp., White, No. 719.
jenneyi D. W., White, No. 719.
missouriensis Lx., White, Nos. 719, 720.
var. nervosa n. var., White, No. 719.
scheuchzeri Hoffm., White, Nos. 719, 720.
Niso umbilicata Lea, Harris, No. 281.
Nucleospira Hall, Grabau, No. 229.
concinna Hall, Grabau, No. 229.
Nucula Lamarck, Grabau, No. 229.
corbuliformis Hall, Grabau, No. 229.
pulchella n. sp., Beede and Rogers, No. 46.
Nuculana arata (Hall), Girty, No. 222.
Nuculites Conrad. Grabau, No. 229.
nyssa Hall, Grabau, No. 229.
oblongatus Hall, Grabau, No. 229.
tryqueter Conrad, Grabau, No. 229.
Nyctopora Nicholson, Lambe, No. 413.
billingsi Nicholson, Lambe, No. 413.
Obolella gamagei n. sp., Hobbs, No. 320.
loperi n. sp., Walcott, No. 683.
mickwitzi n. sp., Walcott, No. 683.
namouna n. sp., Walcott, No. 683.
pandemia n. sp., Walcott, No. 683.
rhea n. sp., Walcott, No. 683.
Obolus Eichwald, Walcott, No. 683.
anceps n. sp., Walcott, No. 683.
(Lingulella) argutus n. sp., Walcott, No. 683.
auga n. sp., Walcott, No. 683.
bellus n. sp., Walcott, No. 683.
bellulus n. sp., Walcott, No. 683.
desideratus n. sp., Walcott, No. 683.
dubius n. sp., Walcott, No. 683.
ellsi n. sp., Walcott, No. 683.
euglyphus n. sp., Walcott, No. 683.
franklinensis n. sp., Walcott, No. 683.
hayesi n. sp., Walcott, No. 683.
helena n. sp., Walcott, No. 683.
ino sp., Walcott, No. 683.
lamborni var. minimus n. var., Walcott, No. 683.
leos n. sp., Walcott, No. 683.
lineolatus n. sp., Walcott, No. 683.
mosia var. osceola n. var., Walcott, No. 683.
nanno n. sp., Walcott, No. 683.
oweni n. sp., Walcott, No. 683.
phaon n. sp., Walcott, No. 683.
pogonipensis n. sp., Walcott, No. 683.
prindlei n. sp., Walcott, No. 683.
punctatus n. sp., Walcott, No. 683.
rogersi n. sp., Walcott, No. 683.
rotundatus n. sp., Walcott, No. 683.
similis n. sp., Walcott, No. 683.
sinoe n. sp., Walcott, No. 683.
tarpa n. sp., Walcott, No. 683.
willisi n. sp., Walcott, No. 683.
zetus n. sp., Walcott, No. 683.
(Lingulepis) Hall, Walcott, No. 682.
acuminatus var. meeki, Walcott, No. 682.

y—Continued.
l species described—Continued.
eris ? bradleyi Lx., White, No. 720.
heni Lx., White, No. 719.
pia cf. gutbieri Goepp, White, No. 720.
ouriensis n. sp., White, No. 720.
us ? minutus n. sp., Beede, No. 44.
mediavia, Harris, No. 281.
ophloios cyclostigma (Lx.) D. W.,
hite, No. 720.
a eriphyle Billings sp., Lambe, No.
.
minima n. sp., Knowlton, No. 392.
? sp. Stanton, No. 608.
idea d'Orbigny, Grabau, No. 229.
Hall, Grabau, No. 229.
nsis Vanuxem, Grabau, No. 229.
a Hall, Grabau, No. 229.
eryx Marsh, Scott, No. 576.
remnicha Winchell, Walcott, No. 682.
ndbergi Winchell, Walcott, No. 682.
as Breynius, Grabau, No. 229.
x Hall, Grabau, No. 229.
nungense Swallow, Weller, No. 711.
rictum Vanuxem, Grabau, No. 229.
ceratum Hall, Grabau, No. 229.
se Hall, Grabau, No. 229.
Hall, Grabau, No. 229.
dium Hall, Grabau, No. 229.
Hall, Girty, No. 222.
latum Hall, Grabau, No. 229.
non Hall, Grabau, No. 229.
ta Conrad, Grabau, No. 229.
arvula Hall, Grabau, No. 229.
ropia strophomenoides Hall, Girty,
. 222.
etes Fischer de Waldheim, Grabau,
. 229.
striatus Hall, Grabau, No. 229.
nungensis (Conrad), Weller, No. 711.
ualis Hall, Girty, No. 223.
ersus Hall, Grabau, No. 229.
ephalus reynoldsi n. sp., Reed, No. 542.
rium Cope, Cope, No. 118.
eum Cope, Cope, No. 118.
a affinis Lx., Knowlton, No. 392.
ttenuata n. sp., Logan, No. 440.
ti n. sp., Logan, No. 488.
nensis n. sp., Logan, No. 440.
esta Conrad, Logan, No. 440.
ula n. sp., Logan, 440.
ulimarginata, Harris, No. 280.
yroidea n. sp., Logan, No. 440.
rva n. sp., Logan, No. 440.
llensis n. sp., Logan, No. 440.
asensis n. sp., Logan, No. 440.
, Harris, No. 280.
n. sp., Logan, No. 440.
n. sp., Logan, No. 440.
osa, Harris, No. 280.
kensis, Harris, No. 280.
e, Harris, No. 280.
ilecula White, Stanton, No. 608.
eri n. sp., Logan, No. 440.
stoni n. sp., Logan, No. 440.
yllum sp., Girty, No. 223.

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Genera and species described—Continued.
Pachyrhizodus minimus, Stewart, No. 609.
Palæoneilo Hall, Grabau, No. 229.
constricta (Conrad), Grabau, No. 229.
constricta (Conrad)?, Weller, No. 711.
emarginata (Conrad), Grabau, No. 229.
fecunda Hall, Grabau, No. 229.
muta Hall, Grabau, No. 229.
tennistriata Hall, Grabau, No. 229.
truncata Hall, Weller, No. 711.
Paleotrochis, Williams, No. 741.
Paleschara Hall, Grabau, No. 229.
amplectens Hall, Grabau, No. 229.
intercella Hall, Grabau, No. 229.
reticulata Hall, Grabau, No. 229.
Paliurus columbi Heer, Knowlton, No. 392
minimus n. sp., Knowlton, No. 392.
zizyphoides ? Lx., Knowlton, No. 392.
Parabatrachus, Hay, No. 286.
Paracyclas Hall, Grabau, No. 229.
lirata (Conrad), Grabau, No. 229.
Parazyga Hall and Clarke, Grabau, No. 229.
hirsuta Hall, Grabau, No. 229.
Patella geometrica Merriam, Merriam, No. 481.
Patellostium, Girty, No. 222.
nodocostatum (Gurley), Girty, No. 222.
Pecopteris cf. arborescens (Schloth.) Brongn., White, No. 720.
borealis Brongn., Fontaine, No. 188.
clintoni Lx., White, No. 720.
dentata Brongn. (non Will.), White, No. 719.
geyleriana Nathorst, Fontaine, No. 188.
jenneyi n. sp., White, No. 720.
lesquereuxii D. W., White, No. 719.
oreopteridia (Schloth.) Stb., White, No. 719.
polymorpha Brongn,, White, No. 719.
pseudovestita n. sp., White, No. 720.
richardsoni n. sp., White, No. 719.
squamosa Lx., White, No. 720.
unita Brongn., White, No. 719.
vestita Lx., White, No. 720.
var. minor n. var., White, No. 719.
(Asterotheca) hemitelioides Brongn. ?, White, No. 720.
(Asterotheca) squamosa Lx., White, No. 719.
(Dactylotheca) dentata Brongn. (non Will.), White, No. 720.
Pelycictis lobulatus Cope, Cope, No. 118.
Pentacrinus asteriscus Meek and Hayden, Stanton, No. 608.
Pernopecten cooperensis (Shumard), Weller, No. 711.
Persea speciosa Heer, Hollick, No. 328.
Phacops Emmrich, Grabau, No. 229.
hudsonicus Hall, Girty, No. 222.
rana (Green), Grabau, No. 229.
Phaethonides Angelin, Grabau, No. 229.
gemmæus Hall and Clarke, Grabau, No, 229.
Phanerotinus paradoxus Winchell, Weller. No. 711.
Philine alabamensis Ald., Harris, No. 281.

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Genera and species described—Continued.
Phillipsastræa billingsi Calvin, Lambe, No. 414.
verneuili Milne-Edwards and Haime, Lambe, No. 414.
Pholadella Hall, Grabau, No. 229.
radiata (Conrad), Grabau, No. 229.
Pholadomya inæquiplicata n. sp., Stanton, No. 608.
kingi Meek, Stanton, No. 608.
Pholas alatoideus, Harris, No. 280.
Pholidops Hall, Grabau, No. 229.
hamiltoniæ Hall, Grabau, No. 229.
linguloides Hall, Grabau, No. 229.
Phragmites falcata n. sp., Knowlton, No. 392.
? latissima n. sp., Knowlton, No. 392.
Phragmodictya Hall, Hall and Clarke, Nos. 275, 277.
catelliformis Whitfield (sp.), Hall and Clarke, Nos. 275, 277.
(?) crebristriata Hall, Hall and Clarke, Nos. 275, 277.
(?) lineata Hall, Hall and Clarke, Nos. 275, 277.
patelliformis Hall, Hall and Clarke, Nos. 275, 277.
Phyllites crassifolia n. sp., Knowlton, No. 392.
Phyllonotus morulus Har., Harris, No. 281.
Phynchostegium knowltoni, n. sp., Britton, No. 65.
Physospongia Hall, Hall and Clarke, Nos. 275, 277.
alternata Hall, Hall and Clarke, Nos. 275, 277.
colletti Hall, Hall and Clarke, Nos. 275, 277.
dawsoni Whitfield (sp.) Hall and Clarke, Nos. 275, 277.
multibursaria n. sp., Hall and Clarke, Nos. 275, 277.
Pinna peracuta Shumard, Girty, No. 222.
sp., Harris, No. 280.
Pinus gracilistrobus n. sp., Knowlton, No. 392.
iddingsi n. sp., Knowlton, No. 392.
macrolepis n. sp., Knowlton, No. 392.
premurrayana n. sp., Knowlton, No. 392.
susquaensis Dawson, Fontaine, No. 188.
wardii n. sp., Knowlton, No. 392.
Pityoxylon aldersoni n. sp., Knowlton, No. 392.
amethystinum n. sp., Knowlton, No. 392.
Planolites corrugatus n. sp., Walcott, No. 681.
superbus n. sp., Walcott, No. 681.
Plasmopora Milne-Edwards and Haime 1849, Lambe, No. 413.
follis Milne-Edwards and Haime, Lambe, No. 413.
petaliformis Lonsdale (sp.), Lambe, No. 413.
Plataninium haydeni Felix, Knowlton, No. 392.
Platanus cissoides Lesquereux ?, Ward, No. 690.
guillelmæ Goepp, Knowlton, No. 392.
montana n. sp., Knowlton, No. 392.
Platecarpus, Williston, No. 747.

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Genera and species described—Cont
Platyceras Conrad, Girty, No. 22
Conrad, Grabau, No. 229.
bucculentum Hall, Grabau,
carinatum Hall, Grabau, No.
erectum Hall, Grabau, No. 2
symmetricum, Grabau, No. 2
thetis Hall, Grabau, No. 229.
primordialis Hall ?, Walcott,
(Orthonychia) attenuatum
No. 229.
Platycrinus Miller, Grabau, No.
eriensis Hall, Grabau, No. 22
symmetricus Wachsmuth a
Girty, No. 223.
Platyostoma Conrad, Grabau, N
lineata Conrad, Grabau, No.
var. emarginata n. var., G
minutum n. sp., Girty, No. 22
Platyschisma missouriensis n. s
711.
Platyxytrodus striatus, Hay, No.
Plethomytilus Hall, Grabau, No.
oviformis (Conrad), Grabau,
Plethospira ? n. sp., Girty, No. 22
Pleurodictyum Goldfuss, Graba
stylopora (Eaton), Grabau,
Pleuromya subcompressa Meek
608.
Pleurophorus taffi n. sp., Girty,
Pleurotoma cainei n. sp., Harris,
capax Whitf., Harris, No. 281
carlottæ, n. sp., Harris, No. 2
denticulata Edw. var., Harr
exilloides Ald., Harris, No.
georgei n. sp., Harris, No. 28
huppertzi var., Harris, No. 2
langdoni Heilp., Harris, No.
mediavia Har. var., Harris,
var. equiseta n. var., Ha
moniliata Heilp., Harris, No.
moorei Gabb, Harris, No. 281.
nebulosa n. sp., Harris, No.
roscoei n. sp., Harris, No. 28
servatoidea Ald., Harris, N
silicata Ald., Harris, Nos. 2
(-?) siphus Ald., Harris, No.
terebralis Ald. var., Harris,
tombigbeensis Ald., Harris,
vaughani var. sylværupis,
veatchi n. sp., Harris, No. 2
(Mangilia) infans Har., Ha
Pleurotomaria de France, Grab
capillaria Conrad, Grabau,
isaacsi Hall and Whitfield
223.
itys Hall, Grabau, No. 229.
lucinia Hall, Grabau, No. 22
planidorsalis Hall, Grabau,
regulata Hall, Grabau, No.
(?) sp., Girty, No. 223.
Pleurotomella sigma, n. sp., Ha
veatchi n. sp., Harris, No. 2
Poacites sp., Hollick, No. 828.

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pecies described—Continued.
us Hinde, Grabau, No. 229.
s Hinde, Grabau, No. 229.
us Hinde, Grabau, No. 229.
s Hinde, Grabau, No. 229.
formis Hinde, Grabau, No. 229.
s Hinde, Grabau, No. 229.
tus Hinde, Grabau, No. 229.
tus Hinde, Grabau, No. 229.
ps Hinde, Grabau, No. 229.
atus Hinde, Grabau, No. 229.
s Hinde, Grabau, No. 229.
tus Hinde, Grabau, No. 229.
ulatus Hinde, Grabau, No. 229.
plex Hinde, Grabau, No. 229.
aloosaensis n. sp., Johnson, No. 361.
McCoy, Grabau, No. 229.
lex Hall, Grabau, No. 229,
is, Hay, No. 286.
alsamoides Goepp, Knowlton, No.
ogenoides Ward, Knowlton, No.
lifera Heer, Knowlton, No. 392.
a Ward, Knowlton, No. 392.
aria n. sp., Knowlton, No. 392.
lithensis n. sp., Knowlton, No. 392.
cf., P. rectinoda Win., Weller, No.
ssiana Duncan, Vaughan, No. 672.
ya? spertenuis n. sp., Beede, No. 44.
a n. sp., Beede, No. 44.
fulvarupis n. sp., Harris, No. 281.
as n. gen., Clarke, No. 96.
l Clarke, 1885, Clarke, No. 96.
ones and Hall, Grabau, No. 229.
mis n. sp., Matthew, No. 468.
culum Jones, Grabau, No. 229.
is Jones, Grabau, No. 229.
lifera (Hall), Grabau, No. 229.
s Pander, Grabau, No. 229.
iatus Hinde, Grabau, No. 229.
aris Hinde, Grabau, No. 229.
tus Hinde, Grabau, No. 229.
atus Hinde, Grabau, No. 229.
s, Hinde, Grabau, No. 229.
us Hinde, Grabau, No. 229.
us Hinde, Grabau, No. 229.
ri Hinde, Grabau, No. 229.
us Hinde, Grabau, No. 229.
is woolgari Meek, Logan, No. 488.
tya n. gen., Hall and Clarke, Nos. 276.
nia n. sp., Hall and Clarke, Nos. 275,
ise n. sp., Hall and Clarke, Nos. 275,
nia n. sp., Hall and Clarke, Nos. 275,
m Hall (sp.), Hall and Clarke, Nos. 276.
o n. sp., Hall and Clarke, Nos. 275,
ea n. sp., Hall and Clarke, Nos. 275,

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Genera and species described—Continued.
Prismodietya choanæ n. sp., Hall and Clarke, Nos. 275, 276.
  cithara n. sp., Hall and Clarke, Nos. 275, -276.
  conradi Hall (sp.), Hall and Clarke, Nos. 275, 276.
  corynia n. sp., Hall and Clarke, Nos. 275, 276.
  filitextilis Hall (sp.), Hall and Clarke, Nos. 275, 276.
  narthecia n. sp., Hall and Clarke, Nos. 275, 276.
  palæa n. sp., Hall and Clarke, Nos. 275, 276.
  parallela Hall (sp.), Hall and Clarke, Nos. 275, 276.
  polyhedra n. sp., Hall and Clarke, Nos. 275, 277.
  prismatica Hall (sp.), Hall and Clarke, Nos. 275, 276.
  ptionia n. sp., Hall and Clarke, Nos. 275, 276.
  spectabilis n. sp., Hall and Clarke, Nos. 275, 276.
  telum Hall (sp.), Hall and Clarke, Nos. 275, 276.
Productella Hall, Grabau, No. 229.
  alifera n. sp., Girty, No. 223.
  cooperensis Swallow, Girty, No. 223.
  navicella Hall, Grabau, No. 229.
  spinulicosta Hall, Grabau, No. 229.
Productus burlingtonensis Hall?, Girty, No. 222.
  gallatinensis n. sp., Girty, No. 223.
  lævicosta White, Girty, No. 223.
  parviformis n. sp., Girty, No. 223.
  scabriculus Martin, Girty, No. 223.
  semireticulatus (Martin)?, Girty, Nos. 222, 223.
Proetus Steininger, Grabau, No. 229.
  curvimarginatus Hall, Grabau, No. 229.
  loganensis Hall and Whitfield, Girty, No. 223.
  macrocephalus Hall, Grabau, No. 229.
  peroccidens Hall and Whitfield, Girty, No. 223.
  protuderans Hall, Girty, No. 222.
  rowi (Green), Grabau, No. 229.
Promacrus cuneatus Hall, Weller, No. 711.
  websterensis n. sp., Weller, No. 711.
Protagraules priscus Matt., Matthew, No. 468.
Protagriochoerus n. gen., Scott, No. 576.
Protarea Milne-Edwards and Haime, Lambe, No. 413.
  vetusta Hall, Lambe, No. 413.
Protoceras Marsh, Scott, No. 576.
Protogaulus hippodus n. gen. (sp. Cope), Riggs, No. 550.
Protoreodon Scott and Osborn, Scott, No. 576.
Protosalvinia (Sporangites) huronensis, Ami, No. 10.
Protosiphon kempanum Matt., Matthew, No. 468.
Protospyræna gigas n. sp., Stewart, No. 610.

Paleontology—Continued.
Genera and species described—Continued.
Protylopus Wortman, Scott, No. 576.
Pseudocopteris Lx., White, No. 720.
  obtusiloba (Brongn.) Lx., White, No. 720.
  squamosa Lx. sp., White, No. 720.
  sp., White, No. 720.
Pseudoliva scalina Heilp., Harris, No. 281.
  tuberculifera Con., Harris, No. 281.
  vetusta, Harris, No. 281.
  vetusta var., Harris, No. 280.
Pseudomonotis (?) cf. hawni Meek, Beede, No. 43.
    var. equistriata ? sp. ? nov., Beede No. 43.
  robusta sp. ? var. ? nov., Beede, No. 43.
  tenuistriata sp. ? var. ? nov., Beede, No. 43.
Pseudopecopteris macilenta (L. and H.) Lx., White, No. 719.
  squamosa, Lx., White, No. 719.
Pseudo-perna n. gen., Logan, No. 440.
  attenuata n. sp., Logan, No. 440.
  orbicularis n. sp., Logan, No. 440.
  rugosa n. sp., Logan, No. 440.
  torta n. sp., Logan, No. 440.
  wilsoni n. sp., Logan, No. 438.
Pterinea Goldfuss, Grabau, No. 229.
  flabella (Conrad), Grabau, No. 229.
Pterinopecten Hall, Grabau, No. 229.
  conspectus Hall, Grabau, No. 229.
  hermes Hall, Grabau, No. 229.
  undodus Hall, Grabau, No. 229.
Pteris pseudopennæformis, Hollick, No 328.
Pterospermites haguei n. sp., Knowlton, No. 393.
Pterosphenus schucherti n. gen. et sp., Lucas, No. 445.
Ptilodictya Lonsdale, Grabau, No. 229.
  plumea Hall, Grabau, No. 229.
Ptilopora sp., Girty, No. 223.
Ptychoceras near crassum, Harris, No. 280.
Ptychodesma cf. P. minor Hall, Weller, No. 711.
Ptychoparia (E.) affinis Walcott, Walcott, No. 682.
  antiqua Salter sp., Walcott, No. 682.
  (?) diademata Hall sp., Walcott, No. 682.
  llanoensis Walcott (?), Walcott, No. 682.
  penfieldi n. sp., Walcott, No. 682.
  (Lonchocephalus) wisconsensis Owen sp., Walcott, No. 682.
  sp. undet., Walcott, No. 682.
Pycnodus phaseolus, Hay, No. 286.
Pyriopecten Hall, Grabau, No. 229.
  orbiculatus Hall, Grabau, No. 229.
Pyropsis perula Ald., Harris, No. 281.
Quercinium lamarense n. sp., Knowlton, No. 392.
Quercophyllum wyomingense n. sp., Fontaine, No. 188.
  culveri n. sp., Knowlton, No. 392.
Quercus consimilis ? Newby., Knowlton, No. 392.
  ellisiana Lx., Knowlton, No. 392.
  furcinervis americana Kn., Knowlton, No. 392.
  grossidentata n. sp., Knowlton, No. 392.

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Genera and species described—Continued.
Quercus—Continued.
  hesperia n. sp., Knowlton, No. 392.
  (?) magnifolia n. sp., Knowlton, No. 392.
  microdentata n. sp., Hollick, No. 328.
  wardiana Lx. ?, Ward, No. 690.
  weedii n. sp., Knowlton, No. 392.
  yanceyi n. sp., Knowlton, No. 392.
  sp., Knowlton, No. 392.
Reptaria Rolle, Grabau, No. 229.
  stolonifera Rolle, Grabau, No. 229.
Reteporina d'Orbigny, Grabau, No. 229.
  striata Hall, Grabau, No. 229.
Reticularia cooperensis Swallow, Girty, No. 223.
  cooperensis var., Girty, No. 223.
  (?) peculiaris Shumard, Girty, No. 223.
  perplexa (McChesney), Girty, No. 222.
  (?) subrotunda Hall, Girty, No. 223.
Rhabdocarpus multistriatus (Presl.) Lx., White, No. 720.
  (Pachytesta) mansfieldi Lx., White, No. 720.
Rhabdosispongia n. gen., Hall and Clarke, Nos. 275, 276.
  amalthea Hall (sp.), Hall and Clarke Nos. 275, 276.
  condroziana n. sp., Hall and Clarke, Nos. 275, 277.
Rhamnacinium radiatum Felix, Knowlton No. 392.
Rhamnus cleburni Lx., Hollick, No. 328.
Rhipidomella Oehlert, Grabau, No. 229.
  burlingtonensis (Hall), Weller, No. 711.
  cyclas Hall, Grabau, No. 229.
  idonea Hall, Grabau, No. 229.
  leucosia Hall, Grabau, No. 229.
  michelini Léveillé, Girty, No. 223.
  oblata Hall, Girty, No. 222.
    var. emarginata Hall, Girty, No. 222.
  penelope Hall, Grabau, No. 229.
  vanuxemi Hall, Grabau, No. 229.
Rhisodus, Hay, No. 286.
Rhombopora Meek, Grabau, No. 229.
  hexagona (Hall), Grabau, No. 229.
  immersa Hall, Grabau, No. 229.
  lineata Hall, Grabau, No. 229.
  polygona (Hall), Grabau, No. 229.
  reticulata (Hall), Grabau, No. 229.
  tortalinia, Grabau, No. 229.
  (?) transversa (Hall), Grabau, No. 229.
Ringicula butleriana Ald., Harris, No. 281.
  butleriana var. lignitifera Ald., Harris, No. 281.
Rœmerispongia n. gen., Hall and Clarke, Nos. 275, 276.
  gerolsteinensis F. Roemer (sp.), Hall and Clarke, Nos. 275, 276.
Romingeria Nicholson, Lambe, No. 413.
  umbellifera Billings (sp.), Lambe, No. 413.
Rhynchonella gnathopora Meek, Stanton, No. 603.
  myrina Hall and Whitfield, Stanton, No. 603.
Rhynchospira formosa (Hall), Girty, No. 222.
Sagenodus copeanus n. sp., Williston, No. 749.
  textilis, Hay, No. 286.

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d *species described*—Continued.
arians Heer, Knowlton, No. 392.
rgeroceras Hyatt, Clarke, No. 96.
gonum n. sp., Clarke, No. 96.
nolites websterensis n. sp., Weller, No.
opsis variabilis Fontaine, Fontaine, 8.
us affinis Newby., Knowlton, No. 392.
ustifolius Lx., Hollick, No. 328.
ndifoliolus Ward, Knowlton, No. 392.
ndifolioloides n. sp., Knowlton, No. 2.
rdii n. sp., Knowlton, No. 392.
eites americanus Lx., Hollick, No. 328.
us mudgii Lx., Ward, No. 690.
ephalus lanciformis, Hay, Nos. 288, 293.
nphagus, n. sp., Hay, Nos. 288, 293.
Iarris, No. 281.
uisita Ald., Harris, No. 281.
tuba missouriensis n. gen. et. sp., er, No. 711.
nder alabamensis Ald., Harris, No. 281.
aiticus Ald., Harris, No. 281.
lla demissa Con. var., Harris, No. 281.
lprini, Harris, No. 281.
ocrinus sp., Girty, No. 223.
es, Logan, No. 438.
losus, Logan, No. 438.
rreni, Logan, No. 438.
ter lecontei n. sp., Merriam, No. 480.
oolus Ulrich, Grabau, No. 229.
ncatus Hall, Grabau, No. 229.
lus King, Girty, No. 222.
lus King, Grabau, No. 229.
ualis Hall, Weller, No. 711.
nis Herrick, Girty, No. 222.
oressus (Conrad), Grabau, No. 229.
ekanus, n. sp., Girty, No. 222.
ndatus, n. sp., Girty, No. 222.
iniformis, n. sp., Girty, No. 222.
phoria swallovi (Hall), Weller, No. 711.
s calycinus Cope, Cope, No. 118.
oteris distantifolia n. sp., Fontaine, Io. 188.
undifolia n. sp., Fontaine, No. 188.
a gabbi Rémond, Merriam, No. 480.
erlineata Stimpson, Merriam, No. 480.
ula humulis n. sp., Girty, No. 223.
matura n. sp., No. Girty, 223.
disonensis n. sp., Girty, No. 223.
var. pusilla n. var., Girty, No. 223.
a couttsie Heer, Knowlton, No. 392.
acilis Heer, Fontaine. No. 188.
ngsdorfii (Brongn.) Heer, Knowlton, Io. 392.
gnifica n. sp., Knowlton, No. 392.
chenbachi (Geinitz) Heer, Fontaine, Io. 198.
Fontaine, No. 188.
orbis sylværupis n. sp., Harris, No. 281.
tus bilix Con., Harris, No. 281.
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ria sigillarioides (Lx.), White, No. 720.
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Smilax lamarensis n. sp., Knowlton, No. 392.
Smilodon mercerii Cope, Cope, No. 118.
Solariella louisiana Dall., Harris, No. 281.
Solarium bellense n. sp., Harris, Nos. 280, 281.
cupola Heilp., Harris, No. 281.
elaboratum Con., Harris, No. 281.
var. delphinuloides Heilp., Harris, No. 281.
var. intusum n. var., Harris, No. 281.
huppertzi Har. var., Harris, No. 281.
greggi Har., Harris, No. 281.
leanum Dall., Harris, No. 281.
sylværupis Har., Harris, No. 281.
Solenomya parallela n. sp., Beede and Rogers, No. 46.
Solenopleura? weedi, Walcott, No. 682.
Somphospongia n. gen., Beede, No. 44.
multiformis, n. sp., Beede, No. 44.
Sphenolepidium kurrianum (Dunker) Heer, Fontaine, No. 188.
parceramosum Fontaine, Fontaine, No. 188.
Sphenophyllum cuneifolium (Stb.) Zeill., White, No. 719.
emarginatum Brongn., White, No. 720.
lescurianum n. sp., White, No. 720.
majus Brongn., White, No. 720.
suspectum n. sp., White, No. 719.
(Asterophyllites?) fasciculatum (Lx.), White, No. 720.
Sphenopteris brittsii Lx., White, No. 720.
canneltonensis n. sp., White, No. 720.
capitata n. sp., White, No. 720.
chærophylloides (Brongn.) Presl., White, No. 720.
cristata (Brongn.) Presl., White, No. 720.
illinoisensis n. sp., White, No. 720.
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missouriensis n. sp., White, No. 720.
mixta Schimp., White, No. 720.
pinnatifida (Lx.), White, No. 720.
plurinervia Heer?, Fontaine, No. 188.
subcrenulata (Lx.), White, No. 720.
suspecta n. sp., White, No. 720.
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Sphenopteris taffi n. sp., White, No. 719.
van ingeni n. sp., White, No. 720.
wardiana, n. sp., White, No. 720.
(Crossotheca) ophioglossoides (Lx.), White. No. 720.
(Hymenotheca) broadheadi n. sp., White, No. 720.
Sphenotus Hall, Grabau, No. 229.
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Spirialis choctavensis Ald., Harris. No. 281.
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Spirifer Sowerby, Grabau, No. 229.
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asper Hall, Grabau, No. 229.
audaculus (Conrad), Grabau, No. 229.
var. eatoni Hall, Grabau, No. 229.

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  - *Genera and species described*—Continued.
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      - centronatus Winchell, Girty, No. 223.
        - var. semifurcatus n. var., Girty, No. 223.
      - consobrinus d'Orbigny, Grabau, No. 229.
      - engelmanni Meek, Girty, No. 223.
      - granulosus (Conrad), Grabau, No. 229.
        - var. clintoni Hall, Grabau, No. 229.
      - macronotus Hall, Grabau, No. 229.
      - marionensis Shumard (?) Girty, No. 223.
      - marionensis Shumard, Weller, No. 711.
      - mucronatus Conrad, Grabau, No. 229.
      - rockymontanus Marcou, Girty, No. 222.
      - striatus var. madisonensis n. var., Girty, No. 223.
      - subattenuatus Hall, Girty, No. 223.
      - tullius Hall, Grabau, No. 229.
      - (Delthyris) sculptilis (Hall), Grabau, No. 229.
      - (Martinia) subumbonus Hall, Grabau, No. 229.
      - (Reticularia) fimbriatus (Conrad), Grabau, No. 229.
      - sp. Girty, No. 223.
    - Spiriferina solidirostris White, Girty, No. 223.
    - Spirophyton sp., Weller, No. 711.
    - Spirorbis Lamarck, Grabau, No. 229.
      - angulatus Hall, Grabau, No. 229.
    - Stearoceras gibbosum Hyatt, Girty, No. 222.
    - Steganoblastus canadensis, White, No. 725.
    - Stemmatia bicristatus, Hay, No. 286.
      - bifurcatus, Hay, No. 286.
      - cheiriformis, Hay, No. 286.
      - compactus, Hay, No. 286.
      - keokuk, Hay, No. 286.
      - symmetricus, Hay, No. 286.
    - Stiboriopsis n. gen., Vaughan, No. 672.
      - jamaicaensis n. sp., Vaughan, No. 672.
    - Stictopora Hall, Grabau, No. 229.
      - palmipes Hall, Grabau, No. 229.
      - permarginata Hall, Grabau, No. 229.
      - recta Hall, Grabau, No. 229.
      - sinuosa Hall, Grabau, No. 229.
    - Stictoporella (?) sp,, Girty, No. 223.
    - Stigmaria evenii Lx., White, No. 720.
      - verrucosa (Martin) S. A. Miller, White, No. 720.
    - Straparollus Montfort, Grabau, No. 229.
      - rudis Hall, Grabau, No. 229.
      - utahensis Hall and Whitfield, Girty, No. 223.
      - ? sp., Weller, No. 711.
    - Streblotrypa Ulrich, Grabau, No. 229.
      - hamiltonense (Nicholson), Grabau, No. 229.
    - Streptelasma Hall, Grabau, No. 229.
      - rectum, Hall, Grabau, No. 229.
      - ungula Hall, Grabau, No. 229.
      - waynense (Safford), White, No. 222.
    - Strepula Jones and Hall, Grabau, No. 229.
      - sigmoidalis Jones, Grabau, No. 229.
    - Striatopora Hall, Lambe, No. 413.
      - flexuosa Hall, Lambe, No. 413.
      - linneana Billings, Lambe, No, 413.

- **Paleontology**—Continued.
  - *Genera and species described*—Continued.
    - Strophalosia King, Grabau, No. 229.
      - truncata (Hall), Grabau, No. 229.
    - Stropheodonta, Hall, Grabau, 229.
      - demissa Conrad, Grabau, No. 229.
      - concava Hall, Grabau, No. 229.
      - plicata Hall, Grabau, No. 229.
      - (Leptostrophia) perplana Conrad, Grabau, No. 229.
      - (Donvillina) inæquistriata (Conrad), Grabau, No. 229.
      - (Pholidostrophia) nacrea (Hall), Grabau, No. 229.
      - (Leptostrophia) junia Hall, Grabau, No. 229.
    - Strophocrinus dicyclicus n. gen. et sp., Sardeson, No. 565.
    - Stylarea von Seebach, Lambe, No. 413.
      - parva Billings (sp.), Lambe, No. 413.
    - Styliolina Karpinsky, Grabau, No. 229.
      - fissurella Hall, Grabau, No. 229.
      - spica (Hall), Grabau, No. 229.
    - Stylocœnia duerdeni n. sp., Hill, No. 672.
    - Surcula nasuta Whitf., Harris, No. 281.
    - Sycium cloacinum Cope, Cope, No. 118.
    - Syringolites Hinde 1879, Lambe, No. 413.
      - huronensis Hinde, Lambe, No. 413.
    - Syringopora Goldfuss, Lambe, No. 413.
      - aculeata n. sp., Girty, No. 223.
      - bifurcata Lonsdale, Lambe, No. 413.
      - compacta Billings, Lambe, No. 413.
      - dalmanii Billings, Lambe, No. 413.
      - hisingeri Billings, Lambe, 413.
      - infundibula Whitfield, Lambe, No. 413.
      - intermedia Billings, Lambe, No. 413.
      - maclurei Billings, Lambe, No 413.
      - nobilis Billings, Lambe, No. 413.
      - perelegans Billings, Lambe, No. 413.
      - ramulosa Goldfuss, Lambe, No. 413.
      - reticulata Goldfuss, Lambe, No. 413.
      - retiformis Billings, Lambe, No. 413.
      - surcularia n. sp., Girty, No. 223.
      - verticillata Goldfuss, Lambe, No. 413.
    - Syringotheris carteri (Hall), Weller, No. 711.
      - carteri Hall, Girty, No. 223.
    - Syrnola dalli Coss. var., Harris, No. 281.
      - trapaquara Har. n. sp., Harris, No. 281.
    - Tæniophyllum latifolium n. sp., White, No. 720.
    - Tæniopteris ? missouriensis D. W., White, No. 720.
    - Tænipora Nicholson, Grabau, No. 229.
      - exigua Nicholson, Grabau, No. 229.
    - Tapirus haysii Leidy, Cope, No. 118.
    - Taxites olriki Heer, Knowlton, No. 392.
    - Taxocrinus Phillips, Grabau, No. 229.
      - nuntius Hall, Grabau, No. 229.
    - Tancredia ? knowltoni n. sp., Stanton, No. 608.
    - Teinostoma subangulatus Meyer, Harris, No. 281.
    - Teleopternus Cope, Cope, No. 118.
      - orientalis Cope, Cope, No. 118.
    - Tellinopsis Hall, Grabau, No. 229.
      - subemarginata (Conrad), Grabau, No. 229.
    - Telmaticyon n. gen., Marsh, No. 464.

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istriatus Hall, Grabau, No. 229.
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agner, No. 679.
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era præcursoria Lx., Hollick, No. 328.
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i n. sp., Hall and Clarke, Nos. 275, 277.
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276, 277.
n. sp., Hall and Clarke Nos. 275, 276.
n-halli nom. nov., Hall and Clarke,
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toni n. sp., Hall and Clarke, Nos. 275,
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ngulare Conrad (sp.), Clarke, No. 96.
ar. compressum n. var., Clarke, No. 96.
ar. obesum n. var., Clarke, No. 96.
anguillulatus Cope, Cope, No. 118.
longipetiolatum n. sp., Hollick, No.
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Trematospira Hall, Grabau, No. 229.
    gibbosa, Grabau, No. 229.
    (Billings) ?, Girty, No. 222.
Triboloceras digonum (M. and W.) ?, Weller, No. 711.
Trigeria Bayle, Grabau, No. 229.
    (?) lepida Hall, Grabau, No. 229.
Trigonia elegantissima Meek, Stanton, No. 603.
    eufaulensis Harris, No. 280.
    montanaensis Meek, Stanton, No. 603.
Triton tuomeyi Ald., Harris, No. 281.
    (Epidromus) otopsis Con., Harris, No. 281.
    (Ranularia) eocensis Ald., Harris, No. 281.
Tritonidea johnsoni Ald., Harris, No. 281.
    pachecoi n. sp., Harris, No. 280.
Triumphis hatchetigbeensis Ald., Harris, No. 281.
Trochoseris catadupensis n. sp., Vaughan, No. 672.
Trochosmilia hilli n. sp., Vaughan, No. 672.
Trophon caudatoides Ald., Harris, No. 281.
    elegantissimus Ald., Harris, No. 281.
    gracilis Ald., Harris, No. 281.
    sublevis n. sp., Harris, No. 281.
Tropidodiscus cyrtolites (Hall), Weller. No. 711.
Tropidoleptus Hall, Grabau, No. 229.
    carinatus (Conrad), Grabau, No. 229.
Tuba antiquata Con., Harris, No. 281.
Turbinella (Glyptostyla ?) baculus Ald., Harris, No. 281.
Turbinoserie Duncan, Vaughan, No. 672.
    cantabridgiensis n. sp., Vaughan, No. 672.
    jamaicaensis n. sp., Vaughan, No. 672.
Turbonilia sp., Harris, No. 281.
Turritella clevelandia Ald. var., Harris, No. 281.
    humerosa Con., Harris, Nos. 280, 281.
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    warrenensis n. sp., Hall and Clarke, Nos. 275 and 277.
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Ulmus minima ? Ward, Knowlton, No. 392.
    pseudo-fulva ? Lx., Knowlton, No. 392.
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Umbrella sylværupis n. sp., Harris, No. 281.
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Uncia inexpectata Cope, Cope, No. 118.
Uncinulus ? acutiplicatus (Hall), Girty, No. 222.
    pyramidatus Hall ?, Girty, No. 222.
Unitrypa Hall, Grabau, No. 229.
    scalaris Hall, Grabau, No. 229.
Ursus americanus Pallas, Cope, No. 118.
    haplodon Cope, Cope, No. 118.
Venericardia planicosta, Harris, No. 280.
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Viburnites evansanus Ward, Ward, No. 690.

- **Paleontology**—Continued.
  - *Genera and species described*—Continued.
    - Viburnum rotundifolium Lx., Knowlton, No. 392.
    - Vitulina Hall, Grabau, No. 229.
      - pustulosa Hall, Grabau, No. 229.
    - Voluta claræ n. sp., Harris, No. 281.
      - newcombiana Whitf., Harris, No. 281.
      - sp., Harris, No. 281.
    - Volutilithes petrosus Con., Harris, Nos. 280, 281.
    - Volvaria (Volvariella) alabamiensis Ald., Harris, No. 281.
    - Vulpes cinereoargentatus, Cope, No. 118.
      - latidentatus, n. sp., Cope, No. 118.
    - Weichselia reticulata (Stokes & Webb) Ward n. comb., Fontaine, No. 188.
    - Williamsonia? phoenicopsoides Ward n. sp., Fontaine, No. 188.
    - Woodwardia preareolæa n. sp., Knowlton, No. 392.
    - Xenodus hertzeri, Hay, No. 286.
    - Xenophora conchyliophora Born., Harris, No. 281.
    - Xiphactinus Leidy, Stewart, No. 608.
      - brachygnathus n. sp., Stewart, No. 610.
    - Yoldia glabra n. sp., Beede and Rogers, No. 46.
    - Zaconthoides sp. undet., Walcott, No. 682.
    - Zamenis acuminatus Cope, Cope, No. 118.
    - Zamites borealis Heer, No. 188.
      - brevipennis Heer, Fontaine, No. 188.
      - (?) sp., Fontaine, No. 188.
    - Zaphrentis Rafinesque, Grabau, No. 229.
      - gigantea Lesueur sp., Lambe, No, 414.
      - minas Dawson, Lambe, No. 414.
      - mirabilis Billings sp., Lambe, No. 414.
      - simplex Hall, Grabau, No. 229.
    - Zephyroceras cataphractum n. sp., Clarke, No. 96.
      - holzapfeli n. sp., Clarke, No. 96.
    - Zizyphus serrulata Ward, Knowlton, No. 392.
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    - Tourmaline-schists, Patton, No. 517.
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    - Geologic notes on Wichita Mountains, Vaughan, No. 671.
  - *Jamaica.*
    - Geology of Jamaica, Hill, No. 313.
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    - Geology of eastern Berkshire County, Emerson, No. 176.
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    - Petrographic province of Essex County, Washington, Nos. 694, 695, 696, 697.
  - *Mexico.*
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Gabbro, Barlow, No. 32.
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Gabbro, Iddings, No. 347.
Gabbro, Turner, No. 635.
Gabbro, Turner and Ransome, No. 639.
Gabbro, Washington, No. 694.
Gabbro-diorite, Cross, No. 128.
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UNITED STATES GEOLOGICAL SURVEY

CHARLES D. WALCOTT, DIRECTOR

A SYNOPSIS

OF

RICAN FOSSIL BRYOZOA

INCLUDING

BIBLIOGRAPHY AND SYNONYMY

BY

IN M. NICKLES AND RAY S. BASSLER

WASHINGTON
GOVERNMENT PRINTING OFFICE
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LETTER OF TRANSMITTAL.

CINCINNATI, OHIO,
May 21, 1900.

ave the honor to submit herewith, for publication as a
the United States Geological Survey, the manuscript of a
by Mr. Ray S. Bassler and myself, entitled A Synopsis
n Fossil Bryozoa, including Bibliography and Synonymy.
y respectfully,

JOHN M. NICKLES.

ARLES D. WALCOTT,
ector United States Geological Survey.

YNOPSIS OF AMERICAN FOSSIL BRYOZOA.

By John M. Nickles and Ray S. Bassler.

INTRODUCTION AND ACKNOWLEDGMENTS.

uminous has the literature of natural history become that the in any special branch, and the general student as well, feel the ompilations showing what has been done. This need, keenly r study of the fossil bryozoa, compelled us to begin such a ion some years ago. This we now place at the service of our orkers with the hope that it may lighten the labors of the ist and open the way for an enlarged use of the bryozoa in phy.

ryozoa are generally admitted to be one of the most difficult f fossils. They are often of small size and can seldom be ed by the unassisted eye. Their accurate discrimination tes tedious study. Few have cared to give this. Because, t uncertainty has prevailed as to what constitutes classifica- racters, a large amount of confusion and synonymy cumbers ature of the subject. Thus the study of the bryozoa has loubly repellent.

tended investigations of the structure of fossil bryozoa made E. O. Ulrich, following in the lines pioneered by Dr. H. Nicholson, have shown that we can not be sure of the position orm in the scheme of classification until we have learned its structure by means of thin sections examined microscopically. le of investigation is difficult and tedious, but our studies have d us that a knowledge of internal characters is absolutely to a correct understanding of phylogeny and systematic

t few authors have described the internal structure of their and as those who have given descriptions have not always had nderstanding of what is essential in the appearance presented ections, it is not possible to be sure of the generic placement e number of species. Some authors have referred species to which we are certain they do not belong; but as enough has made known of such forms to enable us to refer them to other genera, even doubtfully, we have left the species where placed by authors, but have followed the generic name with two interro points (??).

We have deemed it best to be conservative in the matter of red to synonyms, and only where the author himself or some very authority or our own investigation has justified such a course ha relegated a species to synonymy. At the same time we feel sur future studies will show that a considerable number of species in our catalogue as valid are synonyms of species previously desc This is especially the case with the bryozoa of the Hamilton g These have been dealt with by a number of workers, most of have seemed to not concern themselves very much about what may have been doing.

Some genera which future research may prove to be bryozo have excluded. Such are Aulopora, Monilopora, Vermipora, atopora, Michelinia, Chætetes, Favosites, and Tetradium.

The catalogue gives a list, complete so far as we know, described species of bryozoa from American Paleozoic forma arranged alphabetically under their genera, which are also arr alphabetically for convenient reference. The bibliography of species is given under its caption, thus enabling the student to trace the history of any particular form in the literature. Th tions under the genus nearly always refer to a diagnosis; it has s to be of no value to record citations which do not contain some stantial contribution to the knowledge of the genus.

We have not been able to deal with American Mesozoic and Te bryozoa in the same manner. Practically nothing has been don these since the work of Gabb and Horn in 1862. But not mu be done yet, for the classification below the higher groups of rece post-Paleozoic bryozoa is in a most chaotic condition. This syst zation must be done by European writers, as America has but a paratively feeble representation of post-Paleozoic bryozoa. The s is difficult, but the researches of Smitt, Hincks, Jullien, and esp Waters, are laying a sure foundation upon which the classificat the future may be safely builded. As the best that can be d present, we have given a list of all publications describing Am Mesozoic and Tertiary bryozoa, with the species described in ea

As additional helps to the study of the bryozoa we have given outline of the classification, with terminology and diagnoses of g families, and suborders; tables showing the distribution of gene species geologically; and various notes and hints that we deemed prove acceptable to the student.

One feature we have added which seems a little foreign to ou pose, but we believe it will be appreciated. It is a list of public as complete as we have been able to make it, treating of br will give a very fair idea of what has thus far been done for zoa. For kindly help which has done much to make this list it is, we have to thank Dr. Josua Lindahl, the accomplished of the Cincinnati Society of Natural History, and many work-ad, more particularly Prof. Sidney F. Harmer, Mr. Arthur Waters, Dr. Ed. Pergens, Prof. Hinrich Nitsche, Prof. E. Prof. F. A. Smitt, M. Gustave Dollfus, Inspector G. M. R. n, Mr. Robert Etheridge, jr., and Dr. A. Neviani.

ains to acknowledge our very great indebtedness to Mr. E. O. of whose lifelong studies of the bryozoa, published and unpub-arried on with a most noble integrity of purpose, often under toward circumstances, we have been freely permitted to avail s.

e Director of the United States Geological Survey, Hon. D. Walcott, whose keen appreciation of all that tends to fur-ogical and paleontological science has been many times proved, ndebted for many favors.

EXPLANATORY NOTES.

seemed advisable to give a few brief explanatory notes.

the catalogue of genera and species, valid genera and species ack-faced type; an interrogation point following the generic dicates that it is not certain that the species belongs to the nder which it is placed; two interrogation points following ric name indicate that, while we have left the species where it rred by the author, we know that it does not belong there, o not know where it does belong. As a rule, we have excluded ecies from the tables giving the numbers of species.

giving the geologic formation we have usually adhered to ly accepted designations, though this sometimes produces ambiguity. Thus, when Trenton appears alone, followed by lity, it denotes the group; when followed by a parenthesis g Black River or Stones River it denotes the period. Trenton theses means the group. For the Trenton period Clarke and rt[1] have proposed the name Mohawkian.

the term Cincinnati (period) we have given the group in ses. This we have done because very few authors have e group from which their species were derived. The recog- these groups is comparatively recent.

ower Helderberg we have included with the Silurian in our formations. It is still an open question to which age it more belongs, the Devonian or the Silurian.

ve continued to use the name Upper Helderberg, though the sterian, lately proposed by Clarke and Schuchert,[1] may prove a better designation. Prof. James Hall regarded the locality at the Falls of the Ohio as of Upper Helderberg age, but we have followed Mr. E. O. Ulrich in considering this locality of Hamilton age. Future researches may prove that the Upper Helderberg and Hamilton, as now commonly understood, are to some extent synchronous.

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[1] Science, new ser., X, 1899, pp. 874-878.

To avoid ambiguity we have adopted the term Mississippian for the formations underlying the Coal Measures and overlying the Devonian, and have used the grouping of these formations given by Williams and Keyes, with some modifications.

3. In the diagnoses of suborders, families, and genera we thought it advisable to give the number of undescribed species known to us, as it would give a better idea of the number of bryozoa known from American Paleozoic strata. These undescribed species are in the collections of Mr. E. O. Ulrich and the authors.

4. In the list of publications preceding the catalogue of genera and species we have placed an asterisk before those which are of most importance to the student of the bryozoa. The dates we have given do not always agree with those on the title-pages. We have given the date of distribution in cases where we know this to be different from the date of publication.

CLASSIFICATION.

SYSTEMATIC POSITION.

The earliest investigators of the bryozoa regarded them as plants, but by the beginning of the nineteenth century there was general agreement among naturalists as to the animal nature of these organisms, often so plant-like in appearance. For a time their systematic position remained in doubt, and they were uneasily shifted from class to class. In 1830 J. V. Thompson published his discoveries, On Polyzoa, a New Animal Discovered as an Inhabitant of some Zoophites;[1] whence most British authors have applied the name Polyzoa to these organisms, speedily dignified as a class. Almost simultaneously C. G. Ehrenberg[2] separated these organisms as a group of his Phytozoa Polypi under the name Bryozoa; which name became current among Continental authors and seems now gradually superseding Thompson's name also among British writers. For a considerable time the Bryozoa, with the Brachiopoda and Ascidia, formed the "subkingdom" Molluscoidea, but the Ascidia have been removed from this assemblage, and doubts have arisen whether the points of agreement of bryozoa and brachiopoda are of fundamental importance. The determination of the exact affinities of the bryozoa remains a subject for investigations.

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[1] Zool. Researches, No. 5, pp. 89-102, pls. i-iii.

[2] Symbolæ Physicæ, seu Icones et Descriptiones Animalium Evertebratorum, 1828-1831.

HISTORY OF CLASSIFICATION.

The first serious attempt at a classification of the bryozoa was made by D'Orbigny.[1] D'Orbigny's wide acquaintance with recent and fossil bryozoa has perhaps been equaled by no subsequent writer. But the system he devised was so largely artificial and burdened with so perplexing a nomenclature that it failed to gain acceptance. The labors of Nitsche, Allman, and Busk have fixed the principal groups. To Nitsche[2] is due the division into the two groups Ectoprocta and Entoprocta, the latter containing only the two singular genera Pedicellina and Loxosoma. Allman[3] formed the orders Phylactolæmata and Gymnolæmata, the latter including most of the bryozoa and all forms capable of preservation as fossils. Busk's suborders Chilostomata, Cyclostomata, and Ctenostomata[4] have been generally accepted. To these suborders Mr. Ulrich, in 1882,[5] added the suborder Trepostomata, to include, besides uncontested bryozoa, a number of forms which had been generally regarded as corals; and Mr. G. R. Vine, in 1883,[6] added the suborder Cryptostomata.

Recently Dr. J. W. Gregory[7] has raised these suborders to the rank of orders, and for the Chilostomata proposes five suborders: the Stolonata, with the families Æteidæ, Eucratiidæ, and Chlidoniidæ; the Cellularina, with the families Cellulariidæ, Bicellariidæ, Epistomiidæ, Catenicellidæ, and Bifaxariidæ; the Athyriata, with the families Farciminariidæ, Flustridæ, Membraniporidæ, Cribrilinidæ, Microporidæ, Steganoporellidæ, and Cellariidæ; the Schizothyriata, with families Schizoporellidæ, Adeonellidæ, and Microporellidæ; and the Holothyriata, with the families Lepraliidæ, Celleporidæ, and Smittiidæ. For the Cyclostomata he proposes three suborders: the Articulata, with one family, the Crisiidæ; the Tubulata, with the families Tubuliporidæ, Entalophoridæ, Idmoneidæ, Horneridæ, Fascigeridæ, Osculiporidæ, and Theonoidæ; and the Dactylethrata, with the families Clausidæ and Reticuliporidæ.

Zittel, in his excellent Handbuch der Palæontologie (Leipzig, 1880), utilizing the labors of Nitsche, Allman, Busk, Smitt, Hincks, Reuss, Stoliczka, and others, gave probably as good a classification as could be given at that time. We have followed in the main the classification in the English edition of Zittel's Textbook of Palæontology (Macmillan & Co., London, 1896); the section of this edition relating to the bryozoa was revised and in large part rewritten by Mr. E. O. Ulrich. Departures from this classification are based mainly upon later, hitherto unpublished, studies of this author.

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[1] Pal. Franc. Terr. Crétacé, V, 1850–1.
[2] Zeitschrift für wissenschaftliche Zoologie, XX, 1869.
[3] Monograph of the Freshwater Polyzoa, 1856, p. 10.
[4] British Museum Catalogue of Marine Polyzoa, 1852.
[5] Jour. Cincinnati Soc. Nat. Hist., V, p. 151.
[6] Rept. Brit. Assoc. Adv. Sci., p. 196.
[7] Trans. Zool. Soc. London, XIII, 1893, and British Museum Catalogue of Jurassic Bryozoa, 1896.

While there is general agreement as to the suborders ar
groups, confusion reigns in the arrangement of the genera i
lies, more especially of the post-Paleozoic forms. This is du
measure to the fact that the importance of the various struc
tures is very differently rated. Formerly most writers c
zoarial features of chiefest importance for family and gene
ings, but of late there has come substantial agreement th
features far outweigh zoarial characters for classificatory
But as to the relative importance of the various zoœcial c
there is no agreement. A great deal of study is still requi
cially to determine the relationship of Paleozoic to later forn
the principles of classification applicable to this class shall h
established that a classification can be made which will b
phylogenetically.

OUTLINE OF CLASSIFICATION.

The subordination of the larger groupings of the bryozoa
in the tabular form following:

Subkingdom MOLLUSCOIDEA.
    Class BRYOZOA Ehrenberg.
        Group ECTOPROCTA Nitsche.
            Order GYMNOLAEMATA Allman.
                Suborder I. CTENOSTOMATA Busk.
                Suborder II. CYCLOSTOMATA Busk.
                Suborder III. TREPOSTOMATA Ulrich.
                Suborder IV. CRYPTOSTOMATA Vine.
                Suborder V. CHILOSTOMATA Busk.
        Group ENTOPROCTA Nitsche.
            Order PEDICELLINEA Hincks.
    Subclass RHABDOPLEURAE Gill.
            Order PODOSTOMATA Lankester.

SCHEME OF CLASSIFICATION OF PALEOZOIC BRYOZO

Subkingdom MOLLUSCOIDEA.

Class BRYOZOA Ehrenberg.

Group ECTOPROCTA Nitsche.

Order GYMNOLÆMATA Allman.

Suborder CTENOSTOMATA Busk.

Family Rhopalonariidæ.

Rhopalonaria Ulrich.

Family Ascodictyonidæ Ulrich.

Ascodictyon Nicholson and Etheridge, Jun., Vinella Ulrich.

Suborder CYCLOSTOMATA Busk.

Family Diastoporidæ Busk (emend. Ulrich).

topora Bronn, Proboscina Audouin, Berenicea Lamouroux,
toporina Ulrich, ? Hederella Hall, ? Hernodia Hall, ? Reptaria
e.

Family Idmoneidæ Busk.

lla Hall, Protocrisina Ulrich.

Family Entalophoridæ Reuss.

ema Ulrich, Clonopora Hall, Diploclema Ulrich, ? Cystopora
.

Family Phaceloporidæ Ulrich.

opora Ulrich.

Family Ceramoporidæ Ulrich.

opora Hall, Ceramoporella Ulrich, Crepipora Ulrich, Chilopo-
Ulrich, Cœloclema Ulrich, Anolotichia Ulrich, Ceramophylla
ch, Bythotrypa Ulrich, Scenellopora Ulrich, Spatiopora Ulrich.

Family Fistuliporidæ Ulrich.

pora McCoy, Cyclotrypa Ulrich, Eridopora Ulrich, Hexago-
Waagen and Wentzel, Pinacotrypa Ulrich, Chilotrypa Ulrich,
topora Ulrich, Meekopora Ulrich, Lichenotrypa Ulrich, Busko-
Ulrich, Glossotrypa Hall, Selenopora Hall, Favicella Hall,
caulis Hall.

Family Botrylloporidæ.

lopora Nicholson.

Suborder TREPOSTOMATA Ulrich.

Family Monticuliporidæ Nicholson (emend. Ulrich).

ulipora D'Orbigny, Atactoporella Ulrich, Peronopora Nichol-
Homotrypella Ulrich, Homotrypa Ulrich, Prasopora Nicholson
Etheridge, Jun., Aspidopora Ulrich, Mesotrypa Ulrich.

Family Amplexoporidæ Ulrich.

xopora Ulrich, Monotrypella Ulrich, Petalotrypa Ulrich, Dis-
pa Ulrich.

Family Heterotrypidæ Ulrich.

trypa Nicholson, Dekayella Ulrich, Dekayia Milne Edwards
Haime, Petigopora Ulrich, Leptotrypa Ulrich, Atactopora
ch.

Family Batostomellidæ Ulrich.

Batostomella Ulrich, Bythopora Miller and Dyer, Callotrypa Hall, Trematella Hall, Eridotrypa Ulrich, Stenopora Lonsdale, Anisotrypa Ulrich, Lioclema Ulrich, Lioclemella Foerste, ? Thallostigma Hall.

Family Constellariidæ Ulrich.

Constellaria Dana, Stellipora Hall, Nicholsonella Ulrich, Idiotrypa Ulrich, ? Dittopora Dybowski.

Family Trematoporidæ Ulrich.

Trematopora Hall, Batostoma Ulrich, Hemiphragma Ulrich, Stromatotrypa Ulrich, Monotrypa Nicholson, Diplotrypa Nicholson (emend. Ulrich).

Family Calloporidæ Ulrich.

Callopora Hall (emend. Ulrich), ? Calloporella Ulrich.

Suborder CRYPTOSTOMATA Vine.

Family Phylloporinidæ Ulrich.

Phylloporina Ulrich, Drymotrypa Ulrich.

Family Fenestellidæ King.

Fenestella Lonsdale, Semicoscinium Prout, Fenestrapora Hall, Isotrypa Hall, Loculipora Hall, Unitrypa Hall, Hemitrypa Phillips, Helicopora Claypole, Archimedes Owen, Polypora McCoy, Lyropora Hall, Fenestralia Prout, Thamniscus King, Phyllopora King, Reteporidra, Reteporina D'Orbigny, Ptiloporella Hall, Ptiloporina Hall.

Family Acanthocladiidæ Zittel.

Pinnatopora Vine, Acanthocladia King, Septopora Prout, Synocladia King, Ptilopora McCoy, Ichthyorachis McCoy, Diploporaria, ? Ramipora Toula.

Family Sphragioporidæ Ulrich.

Sphragiopora Ulrich.

Family Arthrostylidæ Ulrich.

Arthrostylus Ulrich, Helopora Hall, Arthroclema Billings, Sceptropora Ulrich, Nematopora Ulrich.

Family Rhabdomesontidæ Vine.

Rhombopora Meek, Rhabdomeson Young and Young, Cœloconus Ulrich, Bactropora Hall, Orthopora Hall, Acanthoclema Hall, Nemataxis Hall, ? Tropidopora Hall, ? Streblotrypa Ulrich, ? Hyphasmopora Etheridge, Jun.

Family Chainodictyonidæ.

Chainodictyon Foerste.

Family Ptilodictyonidæ Ulrich.

tya Lonsdale, Escharopora Hall, Clathropora Hall, Phæno-
Hall. Arthropora Ulrich, Graptodictya Ulrich, Stictoporina

Family Stictoporellidæ.

rella Ulrich, Ptilotrypa Ulrich, Intrapora Hall, Coscinella
Tæniodictya Ulrich, Stictopora Hall, Heliotrypa Ulrich.

Family Rhinidictyonidæ Ulrich.

tya Ulrich, Eurydictya Ulrich, Pachydictya Ulrich, Phyllo-
Ulrich, Euspilopora Ulrich, Dicranopora Ulrich, Goniotrypa
, Trigonodictya Ulrich.

Family Cystodictyonidæ Ulrich.

tya Ulrich, Dichotrypa Ulrich, Coscinium Keyserling, Tæ-
a Nicholson, Thamnotrypa Hall, Semiopora Hall, Ptilocella
on, Acrogenia Hall, Prismopora Hall, Scalaripora Hall, Glyp-
Ulrich, Phractopora Hall, Ceramella Hall, Evactinopora
and Worthen, ? Goniocladia Etheridge, Jun.

Family Actinotrypidæ Ulrich.

ypa Ulrich.

Family Cycloporidæ.

ra Prout, Cycloporella Ulrich, Proutella Ulrich, Wortheno-
Ilrich.

Family Rhinoporidæ Ulrich.

ra Hall, Diamesopora Hall, Lichenalia Hall, Stictotrypa Ulrich.

Suborder CHILOSTOMATA Busk.

Family Paleschamidæ Ulrich.

ra Hall.

TERMINOLOGY.

UM (polyzoarium, cœnœcium).—The composite structure
by repeated gemmation. The form which results is very vari-
ugh usually fairly constant for each species. Gemmation in a
roduces *unilaminar* sheets which are often *parasitic* (incrust-
n other organisms, but are sometimes free; in the latter case
ecting covering on the under side is the *epitheca*. Hollow
lined with an epitheca are a special form of this mode of

gemmation. Two unilaminar sheets growing erect, back to back, form a *bilaminar* or *bifoliate* expansion or *frond.* The epithecæ of the two layers of zoœcia thus brought together form a *mesotheca* (mesial or medial laminæ). The small pores seen in the mesotheca, or between the walls of adjoining zoœcia of certain species when thin sections of well-preserved specimens are examined under the microscope, have received the name *median tubuli* (Ulrich).

When gemmation takes places on any side of the zoœcium, *massy* forms result, which may be hemispherical, globular, or discoidal in shape. Gemmation in a particular direction will produce *ramose* or *dendroid* forms.

Among the Fenestellidæ and related families a network is formed. The openings in the network are *fenestrules;* bars connecting the branches are *dissepiments.* The surface upon which the zoœcia open is the *obverse*, the other the *reverse.*

MONTICULES and MACULÆ.—It is quite common, especially in the Trepostomata, for some clusters of zoœcia to outstrip the surrounding zoœcia in growth and tower above them. The rounded elevations thus formed are termed *monticules.* Sometimes the clusters consist of mesopores instead of zoœcia, surrounded by a zone of larger zoœcia. In the latter case the clusters of mesopores may not be elevated above the general level, but may be even depressed below it. Such clusters are called *maculæ.*

ZOŒCIUM (cell).—The cavity with its bounding wall inhabited by the animal. The wall is constructed of laminated tissue. In particularly well-preserved specimens, thin sections reveal very small tubular passages penetrating the walls of adjoining zoœcia. To these Ulrich has applied the term *communication pores.*

In some forms, especially among the Trepostomata, the zoœcia have the form of elongated tubes, which are crossed by partitions termed *diaphragms.* The opening upon the surface of the zoœcium or of the vestibule among the Cryptostomata is the *aperture.* It is often closed by a *zoœcial cover* (closure or operculum).

One side of the zoœcial cavity in some of the Trepostomata is lined with a series of superimposed vesicles, the *cystiphragms* (cystoid diaphragms); their purpose or use is unknown.

Among the Cryptostomata plates frequently project from the walls into the cavity; that upon the posterior wall of the zoœcium is the *superior hemiseptum* (Ulrich), that upon the anterior wall is the *inferior hemiseptum.* The opening of the zoœcium among the Cryptostomata is the *orifice;* the tubular shaft which is left above the orifice as the surface of the zoarium is thickened by strengthening or protective tissue in the *vestibule.*

INTERSPACE.—The part of the surface of the zoarium between the apertures of the zoœcia.

ORES (interstitial cells).—Tubular structures found between ia; they are commonly angular or irregular in outline in ion.

HOPORES (spiniform corallites, spiniform tubuli).—Small l tubes usually situated at the angles of junction of adjoin-a, forming spine-like projections upon the surface.

LAR TISSUE.—In a number of forms the space between the occupied by tissue composed of irregularly superimposed This probably served to give strength to the zoarium and t the zoœcia.

DIAGNOSES OF SUBORDERS, FAMILIES, AND GENERA.

Class BRYOZOA Ehrenberg.

Order GYMNOLÆMATA Allman.

Suborder CTENOSTOMATA Busk.

usually isolated and developed by budding from the inter-a distinct tubular stolon or stem. Orifice terminal, with an n of setæ. Zoarium horny or membranaceous. Marsupia

Family RHOPALONARIIDÆ.

RHOPALONARIA Ulrich.

rm segments (? stolons constricted fusiformly) arranged in a less pinnate manner, impressed or almost embedded in the œcia unknown.

pe and only described species: *Rhopalonaria venosa* Ulrich. rdovician–Devonian. A species very similar to the geno-rs in the Clinton, and another undescribed species is found milton.

Family ASCODICTYONIDÆ Ulrich.

ASCODICTYON Nicholson and Etheridge, Jun.

n parasitic, of thread-like ramifying stolons, with bulbous ents, arranged irregularly or in stelliform clusters; surface punctate. Zoœcia unknown.

pe: *Ascodictyon stellatum* Nicholson and Etheridge, Jun. . Two described species; also several undescribed species Chester group.

VINELLA Ulrich.

n parasitic, consisting of exceedingly slender, ramifying, e, tubular stolons, arranged more or less distinctly in a radial Surface of stolons sometimes faintly lined longitudinally a row of widely separated small pores along the top. Zoœcia .

Genotype: *Vinella repens* Ulrich. Three described and fi species, ranging from Ordovician to Mississippian.

Suborder CYCLOSTOMATA Busk.

Zoœcia simple, tubular; walls thin, minutely porous; ap plain, inoperculate, commonly raised; interspaces with or strengthening tissue; marsupia and appendicular organs w oœcium a large modified cell or an inflation of the zoarial surfa

Family DIASTOPORIDÆ Busk (emend. Ulrich).

Zoarium adnate or erect, the latter unilaminate, bilaminate, c ing hollow stems; zoœcia generally tubular; apertures salient, narrower than the width of the zoœcium, never clustered; int cells wanting; ovicells mere inflations of the surface, with one openings.

Stomatopora Bronn (Alecto Lamouroux, not Leach)

Zoarium adnate, branching dichotomously; zoœcia subtub subpyriform, arranged typically in a single linear series; ap subterminal.

Genotype: *Stomatopora dichotoma* Lamouroux. Range, cian–Devonian; Jurassic–Recent. Nine described and eig Paleozoic species, mostly from the Ordovician.

Proboscina Audouin.

Zoarium adnate, multiserial, rarely widening into a sheet; tubular; apertures subterminal.

Genotype: *Proboscina boryi* Audouin. Range, Ordovician–De Jurassic–Recent. Five described and two new species in A Paleozoic strata, mostly Ordovician.

Berenicea Lamouroux (Diastopora of authors, not Lam Sagenella Hall, Rosacilla Roemer, Diastoporella Vi

Zoarium adnate, forming thin, discoid, flabellate, or irregular zoœcia tubular, arranged in irregularly alternating lines.

Genotype: *Berenicea diluviana* Lamouroux. Range, Ord Silurian, Jurassic–Recent. Six described and several new sp American Paleozoic strata, mainly Ordovician.

Diastoporina Ulrich.

Zoarium bifoliate; zoœcia subtubular, prostrate, immersed tures subcircular, not prominent; zoarial surface between ap finely puncto-striate.

Genotype and only known species: *Diastoporina flabellata* Ordovician.

ystematic position of the following genera, placed provisionally family, is uncertain.

HEDERELLA Hall (NICHOLSONIA Davis).

um adnate, consisting of a tubular axis, from which the zoœcia f alternately to left and right; zoœcia annulated and striated rsely and finely striated longitudinally; apertures terminal, g in width the diameter of the zoœcia.

type: *Alecto canadensis* Nicholson. Devonian. Six species.

HERNODIA Hall.

um adnate, consisting of linear series of elongated, annulated budded from the sides of preceding zoœcia; apertures terminal, g in width the diameter of the zoœcia.

type and only known species: *Hernodia humifusa* Hall. Devo-

REPTARIA Rolle (PTILIONELLA Hall).

um adnate, consisting of cylindrical, annulated zoœcia in con- ; not coalescing along their sides, and proceeding in the plane r host laterally outward from a median line and then upward; es terminal, equaling in width the diameter of the zoœcia.

type: *Reptaria stolonifera* Rolle. Devonian. Two species

Family IDMONEIDÆ Busk.

um of free or adnate subcylindrical or subprismatic branches; apertures rounded, more or less elevated, usually arranged in rse rows on two faces of branches, these two faces sometimes onfluent; dorsal surface of branches without zoœcia; small tubu- es may open on either surface of the branches, but more fre- on the dorsal.

CRISINELLA Hall.

um ramose, solid; celluliferous on one face; apertures arranged , alternately arranged, ascending obliquely from the middle to gins of the branch; peristomes prominent.

type and only known species: *Crisina ? scrobiculata* Hall. n.

PROTOCRISINA Ulrich.

um consisting of narrow, bifurcating branches, celluliferous on e only; zoœcia subtubular, with prominent, circular apertures d in intersecting diagonal series; on both faces small pores rly distributed.

type and only known species: *Protocrisina exigua* Ulrich. cian.

Family ENTALOPHORIDÆ Reuss.

Zoarium ramose, branches free, subcylindrical, with round more or less prominently exserted zoœcial apertures opening on a of the branches.

MITOCLEMA Ulrich.

Zoarium ramose, cylindrical, consisting of long tubular which are thin-walled and prismatic in the axial region, diverge ally from the center, and bend abruptly outward near the s often becoming free and much exserted; apertures terminal, ci usually arranged in regular transverse or subspiral series.

Genotype: *Mitoclema cinctosum* Ulrich. Ordovician. T scribed and one new species.

CLONOPORA Hall.

Zoarium ramose; branches cylindrical, consisting of elongat lar zoœcia, cohering for part of their length, then bending o and becoming free; apertures terminal, not contracted, arran rings or spirally around the branch.

Genotype: *Clonopora semireducta* Hall. Devonian. Three

DIPLOCLEMA Ulrich.

Zoarium dendroid, branches slightly compressed, spreading same plane; zoœcia tubular, diverging from a wavy mesial mes apertures circular; prominent.

Genotype: *Diploclema trentonense* Ulrich. Ordovician, Si Two species.

CYSTOPORA Hall.

Zoarium cylindrical, consisting of tubular, ampullate zoœcia, ing for the greater part of their length; distally the zoœcia be ward, becoming free and much contracted; apertures terminal.

Genotype and only known species: *Cystopora geniculata* Devonian.

Family PHACELOPORIDÆ Ulrich.

PHACELOPORA Ulrich.

Zoarium articulated; zoœcia conical, two or more aggrega form cone-shaped bundles; apertures subterminal, circula slightly contracted.

Genotype and only described valid species: *Phacelopora pe* Ulrich. Ordovician. One new species in the Clinton group.

Family CERAMOPORIDÆ Ulrich.

um variable; maculæ or clusters of mesopores or of zoœcia than usual at regular intervals; zoœcia tubular, at first pros-ontinue obliquely or directly to the surface, often with a few gms; apertures commonly oblique, provided with a lunarium; res generally present, always irregular and usually without gms; walls minutely porous, formed of intimately connected egularly laminated tissue.

CERAMOPORA Hall.

um discoidal, free or attached by the center of the base; under with one or more layers of small, irregular cells; zoœcia radi-ut on the upper surface from a depressed center; apertures , imbricating; mesopores short, irregular, decreasing in num-n center to margin.

type: *Ceramopora imbricata* Hall. Silurian.

CERAMOPORELLA Ulrich.

um of incrusting layers, which by superposition may form zoœcia short, tubular with thin walls; apertures oval, oblique, arium forming a hood; mesopores abundant, often completely ng the zoœcia.

type: *Ceramoporella distincta* Ulrich. Ordovician. Nine ed and twenty new species.

CREPIPORA Ulrich.

um incrusting, lamellate or massive, or, in one species, form-llow branches; zoœcia long, tubular, thin-walled, with dia-s; apertures angular or subpyriform, lunarium not overarch- ends usually projecting; mesopores generally restricted to the , which are elevated or depressed.

type: *Crepipora simulans* Ulrich. Ordovician. Eight de- and six new species.

CHILOPORELLA Ulrich.

um forming parasitic sheets, from which rise flabellate fronds pressed branches; zoœcial tubes long, thin-walled, irregular in n immature region, near the surface walls much thickened, gms rarely developed; apertures ovate, lunarium conspicuously d; mesopores numerous.

type and only described species: *Fistulipora ? flabellata* Ulrich = *pora nicholsoni* James. Ordovician.

CŒLOCLEMA Ulrich.

Zoarium forming hollow branches, lined internally with a striated epitheca; zoœcia as in Ceramoporella, but with thicker walls.

Genotype: *Diamesopora vaupeli* Ulrich = *Ceramopora alternata* James. Ordovician. Four described and three new species.

ANOLOTICHIA Ulrich.

Zoarium ramose, digitate, laminate, or incrusting; zoœcial tubes long, subpolygonal, intersected by remote diaphragms; lunarium elevated at the surface, traversed by two to six minute, vertical, closely tabulated tubes; mesopores sparingly developed.

Genotype: *Anolotichia ponderosa* Ulrich. Ordovician. Two described and three new species.

CERAMOPHYLLA Ulrich.

Zoarium erect, bifoliate, the two layers grown together back to back; in other respects like Ceramoporella and Cœloclema.

Genotype and only known species: *Ceramophylla frondosa* Ulrich. Ordovician.

BYTHOTRYPA Ulrich.

Zoarium massive or lamellate; zoœcial tubes long, intersected by thin diaphragms; apertures subovate, nearly direct, lunarium large, well-raised; mesopores numerous, open at the surface, forming internally a very loose vesicular tissue.

Genotype: *Fistulipora ? laxata* Ulrich. Ordovician. Two species.

SCENELLOPORA Ulrich.

Zoarium simple, pedunculate, under surface epithecated; upper surface slightly concave and celluliferous; zoœcial apertures occupy the summits of low ridges radiating from the center.

Genotype and only known species: *Scenellopora radiata* Ulrich. Ordovician.

SPATIOPORA Ulrich.

Zoarium forming thin crusts, usually on Orthoceras; zoœcia very short, nearly direct; apertures irregular, with blunt spines at the angles, no lunarium developed; elevated, elongated maculæ usually a conspicuous feature.

Genotype: *Spatiopora aspera* Ulrich. Ordovician. Ten described and seven new species.

Family FISTULIPORIDÆ Ulrich.

Zoarium massive, lamellate or ramose, showing on the surface at irregular intervals maculæ or monticules composed of clusters of vesi-

of zoœcia slightly larger than the average; lunarium generally
eloped, sometimes wanting; zoœcial tubes cylindrical or some-
npressed, thin-walled, with diaphragms; walls minutely porous;
es usually direct, closed at times by perforated covers; vesic-
ue occupies the interzoœcial space.

PORA McCoy (LICHENALIA Hall, in part, DIDYMOPORA Ulrich, WSKIA and DYBOWSKIELLA Waagen and Wentzel, FISTULIPO- Simpson).

im massive, lamellate, ramose, parasitic or free; under surface
rinkled epitheca; zoœcia cylindrical or somewhat compressed,
almost so, thin-walled until near the surface, and provided
with a few diaphragms, and encircled by one or more series of
apertures subradially arranged about the maculæ, ovoid, sub-
ar or pyriform, the lunarium more or less strongly developed;
between apertures smooth or granular.
ype: *Fistulipora minor* McCoy = *Calamopora incrustans* Phil-
Range, Silurian–Carboniferous. Sixty-two described and a
able number of new species.

CYCLOTRYPA Ulrich.

Fistulipora, but the lunarium obsolete and the zoœcial tubes
in cross section.
ype: *Fistulipora communis* Ulrich. Devonian. Two species.
work may disclose new species and show that species now
elsewhere belong here.

ERIDOPORA Ulrich (PILEOTRYPA Hall).

im a thin, parasitic sheet; apertures oblique, subtriangular or
unarium very prominent, overarching.
ype: *Eridopora macrostoma* Ulrich. Devonian, Mississippian.
ecies described and several awaiting description.

HEXAGONELLA Waagen and Wentzel.

im as in Fistulipora, but the surface is marked off into gener-
agonal spaces, which are divided from each other by more or
ated ridges, and usually have a macula in the center of the
space.
ype: *Hexagonella ramosa* Waagen and Wentzel. From the
ferous of India. Two undescribed species from the Hamilton
rsaw.

RYPA Ulrich (FISTULIPORINA Simpson, FISTULICELLA Simpson).

im usually a thin contorted expansion, with a wrinkled epitheca
basal surface; zoœcia thin-walled, with a few diaphragms;

interspaces wide, occupied by a single series of large angular mesopores with numerous diaphragms and never presenting the appearance of vesicular tissue; apertures subcircular, with a well-developed granose peristome, but no lunarium.

Genotype: *Fistulipora elegans* Rominger. Devonian.

CHILOTRYPA Ulrich.

Zoarium small, ramose, with a narrow, irregularly contracting and expanding axial tube; diaphragms few or absent; apertures elliptical, oblique, the lower margin thickened and elevated; interstitial vesicles commonly filled by a dense calcareous deposit near the surface.

Genotype: *Chilotrypa hispida* Ulrich. Range, Silurian–Mississippian. Eight described and five new species.

STROTOPORA Ulrich.

Zoarium ramose, with irregular branches. Like Fistulipora, but the surface presents distributed among the apertures large, abruptly spreading cells (regarded as broken ovicells); when perfectly preserved these appear as strongly convex elevations with a small opening on one side.

Genotype: *Strotopora foveolata* Ulrich. Devonian, Mississippian. Three species.

MEEKOPORA Ulrich.

Zoarium bifoliate, sometimes branching; the mesotheca thin and flexuous; zoœcia tubular, proceeding in a gentle curve from the mesotheca and opening somewhat obliquely upon the surface and provided with numerous, often recurved, diaphragms; apertures oblique, all pointing distally; lunarium, when present, not very prominent; rather large ovicells developed, showing at the surface as a convex space with a small apical opening.

Genotype: *Meekopora eximia* Ulrich. Range, Silurian–Carboniferous. Six described and three new species.

LICHENOTRYPA Ulrich.

Zoarium thin, incrusting; in its first stages like Fistulipora; as it matures, large spines and thin walls are thrown up about the apertures; numerous subangular vesicular openings interspersed among the apertures and scarcely distinguishable from them.

Genotype and only known species: *Lichenotrypa cavernosa* Ulrich = *Lichenalia longispina* Hall. Devonian.

BUSKOPORA Ulrich (ODONTOTRYPA Hall).

Like Fistulipora, but lunarium remarkably developed, projecting as a strong, bidenticulate process nearly half way across the aperture.

Genotype: *Buskopora dentata* Ulrich. Devonian. Four species.

GLOSSOTRYPA Hall.

tubular, cylindrical, hollow; diameter of tube 2 mm.; thickness of zoa-
mm. Cells tubular, with frequent narrow projections (semidiaphragms)
ell walls extending partially across the tube; two pseudosepta on one side;
res paliform, very closely disposed, frequently in diagonally intersecting
surface presenting a reticulated appearance; apertures with denticulated
interapertural space elevated, forming ridges; frequently a prominent
e intersection of the ridges, sometimes a depression or pit; surface with
which are laterally in contact, giving to the frond an annulated appear-
cellular space vesiculose.[1]

terpret the foregoing description to mean that the genus is
kopora, save that the lunarium is developed interruptedly in
ial tubes.

ype and only known species: *Lichenalia paliformis* Hall.
n.

SELENOPORA Hall.

m incrusting; surface with circular maculæ surrounded by
rtures; zoœcia tubular, oblique, surrounded by vesicular tis-
rtures subcircular, with overarching lunarium and situated in
l, vestibular areas formed by coalescing ridges traversing the
es.

ype: *Lichenalia circincta* Hall. Devonian. Two species.

FAVICELLA Hall (FISTULIPORIDRA Simpson).

m lamellate, free or incrusting; surface with monticules sur-
by slightly larger apertures; zoœcia tubular, cylindrical, at
trate and thin-walled, then bending rather abruptly and pro-
almost direct to the surface, surrounded by regularly super-
sicles having the appearance of tabulated mesopores; aper-
rcular, with equally elevated peristome, but no lunarium,
in polygonal vestibular areas formed by coalescing angular
aversing the interspaces; vestibular area surrounding the aper-
upied by minute angular pits.

ype: *Thallostigma inclusa* Hall. Devonian. Two species.

COELOCAULIS Hall.

ramose, hollow, inner surface a thin epitheca with transverse wrinkles,
ngitudinal striations; cells tubular, arising from the epitheca and parallel
r a short distance, then turning abruptly outward; apertures circular or
times irregularly disposed, at other times in a more or less regular quin-
er; peristomes thin, distinctly and equally elevated, usually smooth,
imes with numerous nodes or spinules; intercellular space occupied by
disposed vesicles, or by regularly superimposed vesicles, resembling tabu-
ores; interapertural space occupied by minute angular pits.[2]

ype: *Callopora venusta* Hall. Silurian, Devonian. Three

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impson, Fourteenth Ann. Rep. State Geologist New York for the year 1894, p. 562.
bid., p. 554.

Family BOTRYLLOPORIDÆ.

BOTRYLLOPORA Nicholson.

Zoarium of small, circular, parasitic disks which comm lesce, developing along the line of coalescence unusually larg surface marked by ridges radiating from the depressed c increasing in number by bifurcation toward the margin; zoœ occupying the ridges, traversed by occasional diaphragms; space between ridges occupied by vesicles, presenting a sc space; apertures in two rows on the ridges, circular or oval lunarium.

Genotype and only known species: *Botryllopora socialis* N Devonian.

Suborder TREPOSTOMATA Ulrich.

Zoœcia prismatic or cylindrical, coherent tubes clearly sepa two regions, an axial or immature, in which the diaphr remote and the walls thin and prismatic, and a thickened per mature, in which the walls are thickened and otherwise cha phragms are more abundant, and accessory features, such as r and acanthopores, are often developed; zoœcial covers, wit central orifice, present at times, though probably not develo the families; monticules or maculæ a characteristic featu surface.

Family MONTICULIPORIDÆ Nicholson (emend. Ulrich

Zoarium variable; zoœcia with cystiphragms in the matu always; apertures polygonal, rounded or irregularly petalo pores generally present, angular, with numerous diaphrag thopores abundant, usually small.

MONTICULIPORA D'Orbigny.

Zoarium massy, lobate or lamellate, incrusting or free; n usually present; zoœcia prismatic, usually thin-walled, w phragms both in mature and immature regions; apertures p mesopores few or wanting; acanthopores small, generally n

Genotype: *Monticulipora mammulata* D'Orbigny. Ordovi vonian. Sixteen described and sixteen new species.

ATACTOPORELLA Ulrich.

Zoarium generally incrusting, sometimes lobate or su zoœcia with very thin, inflected walls; apertures irregularly mesopores numerous, frequently isolating the zoœcia, largel a secondary deposit; acanthopores very numerous.

Genotype: *Atactoporella typicalis* Ulrich. Ordovician. described and three new species.

PERONOPORA Nicholson.

m bifoliate, through branching of the fronds often forming
ed masses; surface smooth, usually with maculæ; zoœcia with
ick walls, ring-like in transverse section, not inflected by the
ores; cystiphragms abundant; apertures circular or subpolyg-
sopores and acanthopores variable in number.
ype: *Monticulipora frondosa* Nicholson (not D'Orbigny) = *Chæ-*
piens Rominger. Ordovician. Two described and two new

HOMOTRYPELLA Ulrich.

m irregularly ramose or laminar; surface smooth, with small
zoœcia rather thin-walled, cystiphragms usually confined to
er part of the mature region and never present in the axial
apertures subcircular, sometimes faintly petaloid; mesopores
t, more or less completely separating the zoœcia; acanthopores
s.
ype: *Homotrypella instabilis* Ulrich. Ordovician, Silurian.
scribed and five new species.

HOMOTRYPA Ulrich.

m frondescent or ramose; maculæ or monticules of larger cell
s a characteristic feature; apertures often oblique; zoœcia with
or finely crenulated walls and remote diaphragms in imma-
on and cystiphragms, isolated or in series, confined to mature
mesopores few, in clusters; acanthopores generally developed.
ype: *Homotrypa curvata* Ulrich. Ordovician, Silurian. Eight-
ribed and thirty new species.

PRASOPORA Nicholson and Etheridge, Jun.

m massy, usually free, with wrinkled epitheca on the under
zoœcia prismatic or cylindrical, thin-walled, with cystiphragms,
rally surrounded by angular mesopores; acanthopores some-
esent, but rarely numerous or strong; diaphragms crowded
ores.
ype: *Prasopora grayæ* Nicholson and Etheridge, Jun. Ordo-
Fourteen described and six new species.

ASPIDOPORA Ulrich.

m a thin expansion, sometimes of superposed layers, usually
h epitheca on under side; typically composed, according to
rom one to many subequal parts, each gently convex, with the
iminishing in size from center to margin; diaphragms wanting;
agms few in the zoœcia; mesopores numerous, with close dia-
; acanthopores usually present, always small.
ype: *Aspidopora areolata* Ulrich. Ordovician, Silurian. Eight
d and four new species.

MESOTRYPA Ulrich.

Zoarium hemispheric, conical, or discoidal, generally free, with an epitheca on the under surface; zoœcia prismatic or cylindrical, with oblique and sometimes funnel-shaped diaphragms, which are probably modified cystiphragms; zoœcia more or less separated by angular mesopores, which become smaller with age, and are intersected by numerous diaphragms; acanthopores generally present, sometimes of large size.

Genotype: *Diplotrypa infida* Ulrich. Ordovician, Silurian. Ten described and seven new species.

Family AMPLEXOPORIDÆ Ulrich.

Zoarium usually ramose or discoidal, rarely bifoliate; zoœcia simple, prismatic tubes, with a well-marked divisional line (seen in tangential sections as a fine black line) between adjoining tubes; diaphragms present; mesopores practically absent, but small abortive cells sometimes occur among the larger ones in the monticules; acanthopores generally abundant, but may be wanting.

AMPLEXOPORA Ulrich.

Zoarium ramose, discoidal, or massy; zoœcia prismatic, with diaphragms; acanthopores always present, variable in size and number.

Genotype: *Amplexopora cingulata* Ulrich. Ordovician. Eight described and four new species.

MONOTRYPELLA Ulrich.

Like Amplexopora, but distinguished by the absence of acanthopores.

Genotype: *Monotrypella æqualis* Ulrich. Range, Ordovician–Devonian. Nine species.

PETALOTRYPA Ulrich.

Zoarium bifoliate, of irregular compressed branches or simple fronds; zoœcia prismatic, arising from a strongly flexuous mesotheca; apertures subcircular or polygonal; mesopore-like interspaces that do not differ in their tabulation from the zoœcia may occur; very small acanthopores (?) occupy many of the angles of junction.

Genotype: *Petalotrypa compressa* Ulrich. Devonian. Two species.

DISCOTRYPA Ulrich.

Zoarium a thin, free, or parasitic circular expansion; surface smooth, or with low, broad monticules; zoœcia thin-walled, direct; apertures hexagonal or rhomboidal, very regular in their arrangement, decreasing in size from the centers of the monticules outward; neither mesopores nor acanthopores present.

Genotype: *Chætetes elegans* Ulrich. Ordovician, Devonian. Two species.

Family HETEROTRYPIDÆ Ulrich.

m frondescent, ramose, incrusting, or massy; zoœcia polyg-
h moderately thin walls and diaphragms; walls of adjoining
alescent; mesopores often present; acanthopores occur, some-
large size.

HETEROTRYPA Nicholson.

m erect, frondescent, or ramose; zoœcia with numerous dia-
; acanthopores small, of one kind; mesopores variable in
generally abundant, sometimes wanting.
ype: *Monticulipora frondosa* D'Orbigny. Ordovician, ? De-
Eleven described and four new species.

DEKAYELLA Ulrich.

m ramose; zoœcia with numerous diaphragms; two sets of
ores, large and small; mesopores variable in number, gener-
erous.
ype: *Dekayella obscura* Ulrich. Ordovician. Nine described
new species.

DEKAYIA Milne-Edwards and Haime.

m erect, ramose; zoœcia with few diaphragms; acanthopores
arge; mesopores few, or wanting.
ype: *Dekayia aspera* Milne-Edwards and Haime. Ordovician,
an. Six species.

PETIGOPORA Ulrich.

m forming small, circular, incrusting patches; zoœcia direct,
or no diaphragms; acanthopores rather large, of one kind
sopores wanting.
ype: *Petigopora gregaria* Ulrich. Ordovician. Four described
new species.

LEPTOTRYPA Ulrich.

m incrusting, often assuming cylindrical, discoidal, or other
oœcial tubes polygonal, with thin walls, and few or no dia-
; acanthopores very small, never abundant; no mesopores.
ype: *Leptotrypa minima* Ulrich. Ordovician, ? Silurian,
ian. Sixteen described and eight new species.

ATACTOPORA Ulrich.

m forming thin, parasitic expansions, usually on species of
as; zoœcia direct, with few or no diaphragms; surface with
, commonly elongated, subsolid monticules; acanthopores
ery numerous, inflecting the walls, giving the apertures an
or petaloid aspect.
ype: *Atactopora hirsuta* Ulrich. Ordovician. Two described
new species.

ORBIPORA Eichwald (ORBITULITES Eichwald).

Family BATOSTOMELLIDÆ Ulrich.

Zoarium usually ramose; zoœcia with thick walls in the mature region, appearing here to be fused; diaphragms in the peripheral region often centrally perforated; acanthopores and mesopores usually present, the latter small and sometimes moniliform in shape.

BATOSTOMELLA Ulrich (GEINITZELLA Waagen and Wentzel).

Zoarium ramose, branches slender; zoœcia with few diaphragms; apertures of zoœcia small, circular or oval; interspaces rounded or canaliculate, spinulose, the acanthopores small and usually very numerous; mesopores small, with subcircular openings.

Genotype: *Batostomella spinulosa* Ulrich. Range, Silurian–Permian. Six species.

BYTHOPORA Miller and Dyer.

Zoarium ramose, branches usually slender, sometimes of considerable size; zoœcia practically without diaphragms; apertures oblique, narrowing above; interspaces canaliculate; mesopores few; acanthopores comparatively strong, rarely more than one to each zoœcium, sometimes wanting.

Genotype: *Bythopora fruticosa* Miller and Dyer=*Helopora dendrina* James. Range, Ordovician–Devonian. Ten described and five new species.

CALLOTRYPA Hall.

Zoarium ramose; apertures oval, with equally elevated peristomes and with no definite arrangement; interspaces showing the openings of the numerous mesopores by which the zoœcia are surrounded; acanthopores present.

Genotype: *Callopora macropora* Hall. Silurian, Devonian. Ten species.

TREMATELLA Hall.

Zoarium ramose; more or less conspicuously annulated; zoœcia oblique, with a few diaphragms and walls much thickened in the mature region; apertures arranged in a somewhat quincunx order, interspaces ridged, forming polygonal areas; acanthopores sometimes present.

Genotype: *Trematopora annulata* Hall. Devonian. Five species.

ERIDOTRYPA Ulrich.

Zoarium ramose, branches slender; zoœcia more or less oblique, thick-walled, and intersected by diaphragms, which are most numerous and osely set in the earlier portion of the short mature region; es sometimes numerous, sometimes few, with closely set dia- ; acanthopores small, few, or wanting.

ype: *Eridotrypa mutabilis* Ulrich. Range, Ordovician- n. Ten described and four new species.

RA Lonsdale (TUBULICLIDIA Lonsdale, TABULIPORA Young).

m ramose, sublobate, massy, laminar, or parasitic; surface or with monticules; walls of zoœcia thickened periodically in ure region; diaphragms sometimes very few, but in most n species abundant in the mature region and perforated cen- esopores never very numerous, irregularly distributed; large ores at the junction angles.

ype: *Stenopora tasmaniensis* Lonsdale. Mississippian, Car- us. Seventeen described and three new species.

ANISOTRYPA Ulrich.

m ramose, branches sometimes hollow and lined by an epitheca; l line between adjoining zoœcia (as seen in sections) sharply periodical swelling of walls more or less marked; diaphragms perforated, usually numerous; interspaces generally ridge- ither acanthopores nor mesopores.

ype: *Anisotrypa symmetrica* Ulrich. Mississippian. Four

LIOCLEMA Ulrich.

m ramose, lamellar, subglobose or incrusting; surface fre- exhibiting distinct monticules or maculæ; zoœcia with sub- or irregularly petaloid apertures, separated by abundant mesopores, which in some species are open at the surface, in losed; diaphragms few in the zoœcia, abundant, sometimes in the mesopores; acanthopores numerous and strong in the pecies, small and inconspicuous in others.

ype: *Callopora punctata* Hall. Range, Silurian–Mississippian. -nine described and five new species.

LIOCLEMELLA Foerste.

m cylindrical, rarely branched, pointed at the base (for articu- ; otherwise much as in Lioclema.

ype: *Callopora ohioensis* Foerste. Ordovician, Silurian. Six d and five new species.

THALLOSTIGMA Hall.

Family CONSTELLARIIDÆ Ulrich.

Zoarium ramose, frondescent, laminar, or incrusting; zoœ walled and prismatic in the immature region, with thicker v subcylindrical when mature; apertures rounded, peristomes elevated; mesopores angular, abundant, commonly isolating th at intervals gathered into clusters, which are usually stellate, the surface, the closure with numerous minute perforatio acanthopores wanting, but granules often very abundant on t spaces; diaphragms in both zoœcia and mesopores.

CONSTELLARIA Dana.

Zoarium growing into erect, flattened branches or fronds basal expansion which is attached to foreign bodies; surf depressed stellate maculæ, the spaces between the rays elev occupied by two or three short rows or clusters of closely mated apertures; mesopores aggregated into maculæ, intern gradually crowding diaphragms.

Genotype: *Ceriopora constellata* (Van Cleve) Dana. Or Nine described and three new species.

STELLIPORA Hall.

Differs from Constellaria in its incrusting habit and in hav mesopores in the interspaces between the raised zoœcial clust

Genotype and only known species: *Stellipora antheloid* Ordovician.

NICHOLSONELLA Ulrich.

Zoarium a laminar expansion, sometimes giving off flatten twining branches or fronds; interspaces often granose, int spaces wide, filled with numerous mesopores, which have thi more numerous diaphragms than the zoœcial tubes; with age t become filled up with a calcareous deposit, rendering the wal mesopores unrecognizable.

Genotype: *Nicholsonella ponderosa* Ulrich. Ordovician. scribed and nine new species.

IDIOTRYPA Ulrich.

Zoarium parasitic; zoœcia and mesopores alike crossed by t phragms at short and regular intervals, diaphragms apparen forated by numerous minute foramina; mesopores surround th numerous, irregular in shape, closed at the surface; walls wit ous minute vertical tubuli or cells.

Genotype and only known species: *Idiotrypa parasitica* Silurian.

DITTOPORA Dybowski.

Family TREMATOPORIDÆ Ulrich.

rium ramose or incrusting; zoœcia irregular in axial region, their
mal ends with diaphragms and usually constricted where these
; walls thickened in the mature region; lines of contact of walls
joining zoœcia distinct; mesopores generally abundant, usually
ge size, closed at the surface; acanthopores more or less abundant;
ragms in both zoœcia and mesopores.

TREMATOPORA Hall.

rium ramose; surface smooth or with monticules; zoœcia thin-
l and with few diaphragms; apertures circular or oval, with a
or less well-marked peristome; interspaces solid; mesopores
ılarly angular, often obscurely moniliform, with diaphragms at
nstricted parts; acanthopores of medium or small size usually
ıt.

ıotype: *Trematopora tuberculosa* Hall. Ordovician, Silurian.
pecies.

BATOSTOMA Ulrich.

rium irregularly ramose, branches arising from a large basal
sion; zoœcia with walls that are thin in the immature region,
thickened and in sections appearing ringlike (but seldom in con-
n mature region; diaphragms present; mesopores numerous or
rregular in size or shape; acanthopores usually of large size and
lant, sometimes few.

ıotype: *Monticulipora* (*Heterotrypa*) *implicata* Nicholson. Ordo-
. Eighteen described and fifteen new species.

HEMIPHRAGMA Ulrich.

e Batostoma, but diaphragms in mature region of zoœcia
plete.

ıotype: *Batostoma irrasum* Ulrich. Ordovician. Five species.

STROMATOTRYPA Ulrich.

rium consisting of one thin layer, or several superimposed,
ng upon foreign bodies; zoœcia short, with few diaphragms, the
mal end scarcely prostrate, oval in cross section; walls thin, con-
g periodically constricted, bead-like tubuli (modified acantho-
?), one or more to each zoœcium; apertures oval, separated by
ssed interspaces, the peristomes minutely papillose; mesopores
lant, beginning on the basal lamina, decreasing in size with age,
y tabulate, the diaphragms finely punctured, their openings
showing, being closed by a common dermal sheet.

ıotype and only described species: *Stromatotrypa ovata* Ulrich.
vician. Three new species.

MONOTRYPA Nicholson (PTYCHONEMA Hall and Simpson).

Zoarium massy, hemispherical, subglobose, or discoidal; zoœcia not distinguishable into mature and immature regions, comparatively large, prismatic, with walls thin throughout and often crinkled; diaphragms remote; neither mesopores nor acanthopores.

Genotype: *Chætetes undulatus* Nicholson. Ordovician, Silurian. Fourteen described and two new species.

DIPLOTRYPA Nicholson (emend. Ulrich).

Zoarium hemispheric, discoid, globular, or irregularly massy, generally free; zoœcia comparatively large, prismatic, with diaphragms; mesopores few to many, varying in size.

Genotype: *Favosites petropolitanus* Pander. Ordovician, Silurian. Four described and two new species.

Family CALLOPORIDÆ Ulrich.

Zoarium ramose, subfrondescent, or discoidal; zoœcia increasing in size very gradually, their proximal portion very much like mesopores; apertures subcircular, the openings of a greater or less number of mesopores interspersed among them, or polygonal, in which case the mesopores are few or wanting; no acanthopores.

CALLOPORA Hall (emend. Ulrich).

Zoarium usually ramose, the branches frequently anastomosing and forming bushy clumps; zoœcia at first prismatic, four to eight sided, gradually becoming cylindrical in most cases; at first with closely set diaphragms, then diaphragms more distant, finally in the mature region diaphragms usually closely set; apertures closed at times by perforated, often ornamented covers; mesopores more or less numerous, angular, crowded with diaphragms.

Genotype: *Callopora elegantula* Hall. Ordovician, Silurian. Twenty-three described and ten new species.

CALLOPORELLA Ulrich.

Zoarium a thin expansion, free or incrusting; surface smooth or undulated; zoœcia cylindrical, with thick walls and numerous diaphragms; apertures circular, arranged in regular intersecting series; mesopores numerous, angular, surrounding the zoœcia in one or two series; acanthopores small and few.

Genotype: *Calloporella harrisi* Ulrich = *Monticulipora* (*Heterotrypa*) *circularis* James. Ordovician. Three species.

Suborder CRYPTOSTOMATA Vine.

Zoœcia short, pyriform to oblong, quadrate or hexagonal, sometimes tubular; orifice anterior, usually circular; the upper or front

of the zoœcium strengthened by a calcareous deposit, solid or
ular in nature, which, as it proceeds, leaves an opening above the
e, thus producing a shaft or vestibule, which may be crossed by
ragms or hemisepta.

Family PHYLLOPORINIDÆ Ulrich.

arium branching; branches free or anastomosing, celluliferous
ne side only, the other side striated; zoœcia more or less tubular,
with diaphragms; hemisepta wanting.

PHYLLOPORINA Ulrich.

arium with branches irregularly anastomosing, with two to eight
of apertures on the obverse side, on the reverse longitudinally
ed; tabulated interstitial spaces generally present, closed at the
ce; acanthopores often present.
notype: *Retepora trentonensis* Nicholson. Ordovician, Silurian.
en described and four new species.

DRYMOTRYPA Ulrich (THAMNOCELLA Simpson).

arium branching dichotomously at frequent intervals, on reverse
tudinally striated; zoœcia in several ranges, tubular, springing
a thin double plate, beneath which a number of vesicles (aborted
ia?) are present; vestibules expanding from the orifices to the
lar apertures.
notype: *Retepora diffusa* Hall. Ordovician, Silurian. Four
es.

Family FENESTELLIDÆ King.

arium a reticulated expansion, celluliferous on one side only,
osed of rigid branches, united by regular nonporiferous bars
epiments), or branches may be sinuous and anastomose at regular
vals, or may remain free; zoœcia oblong, quadrate, or hexagonal
tline, embedded in a calcareous crust which is minutely porous,
ially on the noncelluliferous side; orifice anterior, semielliptical,
ated behind; apertures rounded, with peristome and closed at
by a centrally perforated closure; a superior hemiseptum gen-
present, an inferior one less frequently.

STELLA Lonsdale (ACTINOSTOMA Young and Young, FLABELLIPORINA Simpson).

arium flabellate or funnel shaped, celluliferous on the inner side;
ches generally straight, sometimes flexuous, connected at regular
vals by dissepiments; apertures in two rows, separated by a
or tuberculated median keel.

Genotype: *Gorgonia antiqua* (Goldfuss?) Lonsdale. Accepted type: *Fenestella plebeia* McCoy. Range, Ordovician–Carboni One hundred and eleven described and a considerable number species.

SEMICOSCINIUM Prout (CRYPTOPORA Nicholson, CARINOPORA Nicl CYCLOPORINA Simpson).

Zoarium funnel shaped, celluliferous on the outer side; dissep wide, very short, the branches appearing to anastomose on th poriferous face, where the fenestrules are subrhomboidal or ro apertures in two rows, median keel very high and expanded summit.

Genotype: *Semicoscinium rhomboideum* Prout. Silurian, Dev Twenty-six species.

FENESTRAPORA Hall.

Zoarium as in Semicoscinium, except that the reverse of the z and the expanded summits of the carinæ bear large scattered p pits.

Genotype: *Fenestrapora biperforata* Hall. Devonian. Three s

ISOTRYPA Hall (TECTULIPORELLA Simpson).

Zoarium funnel-shaped, branches connected by dissepiments tures in two rows, separated by a carina; the carinæ pron expanded at the summit; summits connected by round or oval bars, usually situated above the dissepiments; on the reverse more or less conspicuous pore occurs on or near each dissep The superstructure gives the obverse much the appearance reverse of the zoarium.

Genotype: *Fenestella* (*Isotrypa*) *conjunctiva* Hall. Devonian species.

LOCULIPORA Hall (emend.) (TECTULIPORA Hall).

Zoarium funnel-shaped, branches connected by short, ty reduced to a minimum, nonporiferous dissepiments; apertures rows; branches and dissepiments carinated, the carinæ coal summits of carinæ much expanded, angular, and slightly car their width usually equaling that of the branches and dissep below and hence causing difficulty in distinguishing the obve reverse sides.

Genotype: *Fenestella perforata* Hall. Silurian, Devonian. species.

UNITRYPA Hall.

Zoarium funnel-shaped; branches connected by dissepiments tures in two rows, separated by a carina; carinæ prominent, thi

and connected by thin oblique subimbricating plates (scalæ),
may be as numerous as the zoœcia, or only two to each fenestrule.
otype: *Fenestella* (*Hemitrypa*) *lata* Hall. Silurian, Devonian.
n species.

HEMITRYPA Phillips.

rium as in Fenestella, but has a reticulated superstructure whose
s correspond in number and position with the zoœcial apertures;
ructure rests on pillars which rise at regular intervals from the
ate median keel of the branches.
otype: *Hemitrypa oculata* Phillips. Range, Silurian–Carbon-
s. Sixteen species.

HELICOPORA Claypole.

rium spiral, the inner edge thickened and nonporiferous, but
ıt forming a solid axis; otherwise as in Fenestella.
otype: *Helicopora latispiralis* Claypole. Silurian, Devonian.
pecies.

ARCHIMEDES Owen (ARCHIMEDIPORA D'Orbigny).

rium a spirally wound fenestrated expansion supported by a solid
eous, central axis; otherwise as in Fenestella.
otype: *Fenestella* (*Archimedes*) *wortheni* Hall. Mississippian.
n species.

ORA McCoy (PROTORETEPORA De Koninck, POLYPORELLA Simpson, FLABELLIPORELLA Simpson).

rium as in Fenestella but has from two to eight rows of zoœcia on
ch, and lacks the median keel, though this is sometimes repre-
by a row of strong nodes or tubercles.
otype: *Polypora dendroides* McCoy. Range, Silurian–Carbon-
s. Eighty-two described and other new species.

ORA Hall (LYROPORELLA, LYROPORINA, LYROPORIDRA Simpson).

rium flabellate, the fenestrated portion spread between the arms
onporiferous U or V shaped calcareous support, which is free or
culate at the base; zoœcia in from two to five ranges; no median

otype: *Fenestella* (*Lyropora*) *subquadrans* Hall. Mississippian.
species.

FENESTRALIA Prout.

rium as in Fenestella, but with four rows of apertures, two on
ide of the prominent median keel.
otype: *Fenestralia sancti-ludovici* Prout. Mississippian. Two
s.

THAMNISCUS King.

Zoarium as in Polypora, but branches bifurcate more frequently and are rarely or not at all connected by dissepiments.

Genotype: *Ceratophytes dubius* Schlotheim. Range, Silurian–Carboniferous. Thirteen species.

PHYLLOPORA King.

Zoarium funnel-shaped, celluliferous on the outer face; fenestrules oval, branches anastomosing or connected by broad celluliferous dissepiments; zoœcia in two ranges normally; without median keel.

Genotype: *Gorgonia ehrenbergi* Geinitz. Devonian. One species.

RETEPORIDRA (=RETEPORELLA Simpson)[1] (ANASTOMOPORA Simpson).

Zoarium a flabellate or undulating expansion with thickened margins; branches sinuous or zigzag, anastomosing at short and regular intervals so as to produce a regular series of oval fenestrules; apertures in three to seven rows; branches without a median carina.

Genotype: *Retepora undulata* Simpson=*Fenestella perundata* Hall. Devonian. Three species.

RETEPORINA D'Orbigny.

Zoarium as in Reteporidra, but the zoœcia are in two ranges, with the apertures separated or not by a more or less well-marked median carina.

Genotype: *Retepora prisca* Goldfuss. Devonian, Mississippian. Eight species.

PTILOPORELLA Hall (PINNAPORELLA Simpson, 1897).

Zoarium a fenestrated funnel-shaped expansion; branches of two sizes, the smaller or secondary branches proceeding laterally from the larger or primary ones, either from one or both sides; as the frond expands, other large branches proceed from the primary ones, this process continuing during the growth of the frond; apertures in two rows separated by a carina; the carinæ of the primary branches more prominent than those of the secondary branches.

Genotype: *Fenestella* (*Ptiloporella*) *laticrescens* Hall. Silurian, Devonian. Four species.

PTILOPORINA Hall (PINNAPORELLA Simpson, 1895, PINNAPORINA Simpson).

Zoarium like that of Ptiloporella in mode of growth, but branches have three or more rows of apertures and no median carina.

Genotype: *Fenestella* (*Ptiloporina*) *conica* Hall. Devonian. Four species.

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[1] Reteporidra is proposed for Reteporella, preoccupied by Busk, Challenger Report, X, 1884, p. 126.

Family ACANTHOCLADIIDÆ Zittel.

m a pinnate or fenestrate expansion, celluliferous on one face
nsisting of strong central stems which give off numerous
lateral branches from their margins; the lateral branches are
nite with those of the next stem; nonporiferous dissepiments
esent; zoœcial characters mostly as in the Fenestellidæ.

PINNATOPORA Vine (GLAUCONOME of authors).

m a small delicate stipe, with short, free lateral branches given
ently and at regular intervals; apertures in two rows, sepa-
a moderate median keel.

ype: *Glauconome elegans* Young and Young. Range, Devon-
oniferous. Nineteen species.

ACANTHOCLADIA King.

m as in Pinnatopora, but larger and stronger and with three
rows of apertures between which the surface is elevated into
gitudinal ridges or series of tubercules.

ype: *Ceratophytes anceps* Schlotheim. Carboniferous. One

SEPTOPORA Prout.

m a fenestrate, flabellate or leaf-like expansion; primary
numerous, increasing by bifurcation or interpolation; the
anches unite with those from the adjacent primary branches;
in two rows on primary and lateral branches; reverse usually
striæ and scattered dimorphic pores.

ype: *Septopora cestriensis* Prout. Mississippian, Carbonif-
Eleven species.

SYNOCLADIA King.

m as in Septopora, but branches stronger and with three or
s of apertures, usually between elevated ridges.

ype: *Retepora virgulacea* Phillips. No American species

PTILOPORA McCoy (DENDRICOPORA De Koninck).

m pinnate, the stipe much stronger than the oblique lateral
, which are occasionally and irregularly united by dissepi-
pertures in two rows.

ype: *Ptilopora pluma* McCoy. Devonian, Mississippian.
ecies.

ICHTHYORACHIS McCoy.

m as in Ptilopora, but the stipe bears five or more rows of
and the branches usually three.

ype: *Ichthyorachis newenhami* McCoy. Silurian. One

DIPLOPORARIA (= DIPLOPORA Young and Young).[1]

Zoarium as in Pinnatopora, but has no lateral branchlets.

Genotype: *Diplopora marginalis* Young and Young. Mississippian, Carboniferous. Two species.

RAMIPORA Toula.

Family SPHRAGIOPORIDÆ Ulrich.

SPHRAGIOPORA Ulrich.

Zoarium parasitic, forming small, circular, subhemispheric patches on foreign bodies; zoœcia of the same type as in Fenestella; apertures circular, with a slight peristome, arranged in one or two rows on the summits of slightly elevated, radially arranged, broad ridges; spaces between raised portions solid.

Genotype and only known species: *Sphragiopora parasitica* Ulrich. Mississippian.

Family ARTHROSTYLIDÆ Ulrich.

Zoarium articulated, consisting of numerous subcylindrical segments, united into small pinnate or bushy colonies, or of continuous, dichotomously divided branches; zoœcia subtubular, more or less oblique, radially arranged about a central axis, and opening on all sides of the segments; or one side may be noncelluliferous and longitudinally striated.

ARTHROSTYLUS Ulrich (Arthronema Ulrich).

Zoarium bushy, dichotomously branching, the whole consisting of numerous exceedingly slender, equal, subquadrate segments, united by terminal articulation; one face longitudinally striated, on each of the other, commonly three, faces a linear series of apertures between longitudinal ridges.

Genotype: *Helopora tenuis* James. Ordovician. Four species.

HELOPORA Hall.

Like Arthrostylus, but the segments are generally larger and have zoœcial apertures on all sides.

Genotype: *Helopora fragilis* Hall. Ordovician, Silurian. Twelve species.

ARTHROCLEMA Billings.

Zoarium of segments celluliferous on all sides, articulated terminally and laterally in a pinnate manner; apertures oval, in series between longitudinal ridges.

Genotype: *Arthroclema pulchellum* Billings. Ordovician. Six species.

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[1] Diploporaria proposed for Diplopora, preoccupied by Schafhäutl.

SCEPTROPORA Ulrich.

of segments which become much expanded in their upper
l at the top have a socket for the articulation of the next
ower portion striated, without apertures; upper part with
ll around; apertures subovate, in linear series between lon-
idges.
e: *Sceptropora facula* Ulrich. Ordovician, Silurian. Two

NEMATOPORA Ulrich.

very slender, ramose, continuous above the pointed basal
zoœcia subtubular, arranged radially around one or two
ial tubes; apertures oval or subcircular; with peristome,
n linear series between longitudinal ridges.
e: *Nematopora ovalis* Ulrich. Range, Ordovician–Devo-
een species.

Family RHABDOMESONTIDÆ Vine.

ramose or simple, not articulated, sometimes with an axial
enerally solid, in which case the axial region is occupied by
l primitive tubes, with or without diaphragms; hemisepta
esent, but never conspicuous; apertures circular or oval,
inear series between longitudinal elevated ridges, or in diag-
rsecting series; vestibule a rhombic or hexagonal sloping
pores generally absent.

RHOMBOPORA Meek.

slender, ramose, solid; zoœcia thick-walled in vestibular
ertures in longitudinal or diagonally intersecting series;
es present, sometimes of two kinds, large and small.
e: *Rhombopora lepidodendroides* Meek. Range, Silurian–
ous. Twenty-nine described and several undescribed

RHABDOMESON Young and Young.

with a slender axial tube, to which the proximal ends of
are attached; otherwise like Rhombopora.
e: *Millepora gracilis* Phillips; from the Carboniferous of
nd Scotland. No American species have yet been made

CŒLOCONUS Ulrich.

simple, hollow, very gradually expanding from an attenu-
ed base; zoœcia short, with well developed hemisepta, aper-
agonally intersecting series.
e: *Cœloconus rhombicus* Ulrich. Mississippian. Two

BACTROPORA Hall.

Zoarium simple or only slightly branched; lower extremity pointed; otherwise as in Rhombopora.

Genotype: *Trematopora ? granistriata* Hall. Devonian, Mississippian. Three species.

ORTHOPORA Hall.

Zoarium ramose, solid; apertures in parallel longitudinal rows, with ridges between; acanthopores present.

Genotype: *Trematopora regularis* Hall. Silurian, Devonian. Twenty-six species.

ACANTHOCLEMA Hall.

Zoarium slender, ramose; zoœcia tubular, arising from a filiform axis in the center of the branch; apertures oval, in diagonally intersecting series, or linear series separated by ridges; vestibules polygonal, broadly sloping; acanthopores between the apertures.

Genotype: *Trematopora alternata* Hall. Devonian, Mississippian. Six species.

NEMATAXIS Hall.

Zoarium slender, ramose; zoœcia long, tubular, diverging obliquely from a central filiform axis, near the surface bending abruptly; interspaces solid; apertures oval, in linear series, separated by ridges, with very thin, slightly elevated peristomes; on the surface at intervals there are monticules destitute of cell apertures, which extend around the branch, giving it an annulated appearance.

Genotype: *Nemataxis fibrosus* Hall. Devonian. Two species.

TROPIDOPORA Hall.

Zoarium slender, ramose; apertures in irregular longitudinal series, separated by sinuous ridges, with very thin slightly elevated peristomes.

Genotype and only known species: *Tropidopora nana* Hall. Devonian.

STREBLOTRYPA Ulrich.

Zoarium ramose, slender, solid; zoœcia long, tubular, diverging from the center; inferior hemiseptum best developed, situated rather far down; apertures regularly elliptical, with peristome, usually arranged in longitudinal series; below the apertures there are from one to twelve or more small pits, arranged, when numerous, in two or three rows; occasionally very small acanthopores present.

Genotype: *Streblotrypa nicklesi* Ulrich. Devonian, Carboniferous. Fifteen species.

HYPHASMOPORA Etheridge, Jun.

e Carboniferous of Scotland.

Family CHAINODICTYONIDÆ.

CHAINODICTYON Foerste.

retiform, of inosculating branches, which are undulated y on the reverse; zoœcia elongate, conical, or subtubular; arge, with thin interspaces in several rows, arranged in gonally intersecting series.
e: *Chainodictyon laxum* Foerste. Carboniferous. Two

Family PTILODICTYONIDÆ Zittel.

bifoliate, composed of two layers of zoœcia, grown together k, usually jointed, at least at the base, and forming leaf-like or compressed branching or inosculating stems; mesotheca dian tubuli; zoœcia usually have hemisepta and semiellip-s; apertures usually ovate, surrounded either by a sloping nglike peristome; vestibules separated by thick walls.

TILODICTYA Lonsdale (HETERODICTYA Nicholson).

a simple, unbranched, lanceolate or falciform frond, narrow hich articulates with a small basal expansion; in the young he zoarium consists of longitudinally arranged, narrow, drate zoœcia, new zoœcia of different width and arrange- added subsequently on each side; walls of vestibules thick, vith a double row of minute dots.
e: *Flustra lanceolata* Lonsdale. Ordovician, Silurian. Six-s.

IAROPORA Hall (NICHOLSONIA Waagen and Wentzel).

lodictya, but distinguished chiefly by the arrangement of res, which are in decussating series, and by the sloping area which surrounds the apertures.
e: *Escharopora recta* Hall. Ordovician. Fourteen described, new species.

CLATHROPORA Hall.

composed of anastomosing branches, forming a regular net-round or oval fenestrules, with a pointed, articulating base; usually subquadrate, arranged longitudinally.
e: *Clathropora frondosa* Hall. Silurian, Devonian. Five

PHÆNOPORA Hall.

Like Ptilodictya, except that there are two mesopores in
space between the ends of the apertures.

Genotype: *Phænopora explanata* Hall. Ordovician,
Fourteen species.

ARTHROPORA Ulrich.

Zoarium bushy, composed of numerous articulating equal
spread in a plane; apertures elliptical, surrounded by a del
stome; interspaces with one or more thread-like ridges var
posed, and with a row of minute papillæ.

Genotype: *Stictopora* (*Ptilodictya*) *shafferi* Meek. C
Five described and four new species.

GRAPTODICTYA Ulrich.

Zoarium a narrow bifurcating frond with a pointed base a
with a small basal expansion; apertures subcircular, surrou
peristome subpolygonal in outline; interspaces depressed, us
one or two fine tortuous elevated lines.

Genotype and only known species: *Ptilodictya elega*
Ordovician.

STICTOPORINA Hall.

Zoarium a simple or branching frond, from an obtusel
articulating base; apertures oval, in decussating series, i
rhomboidal or polygonal areas; interspaces elevated, angula
Genotype: *Trematopora claviformis* Hall. Devonian. Thr

Family STICTOPORELLIDÆ.

This family differs from the Ptilodictyonidæ mainly i
zoarium is not articulated, but grows upward from, and is
with, a spreading base.

STICTOPORELLA Ulrich.

Zoarium branching, cribrose, or leaf-like; zoœcia with th
portion tubular, usually long, generally without hemisepta, t
one only occasionally present; orifices at the bottom of a wi
vestibule; thick-walled, untabulated mesopores occur be
apertures and line the margins of the zoarium.

Genotype: *Stictoporella interstincta* Ulrich = *Ptilodicty*
James. Ordovician. Nine described and four new species

PTILOTRYPA Ulrich.

Zoarium ramose, with compressed or frondescent branch
with irregular longitudinally channeled areas appearing lik

g oblique tubes, with an occasional diaphragm; apertures y oblique, acute anteriorly, posterior margin somewhat at the upper extremity of the aperture an accessory pore.

e and only known species: *Ptilotrypa obliquata* Ulrich. n.

INTRAPORA Hall.

ramose, from a spreading base, branches compressed, dividomously; zoœcia tubular, at first parallel to the mesotheca, abruptly outward; apertures oval, with peristome; interth minute angular pits, the openings of the numerous mesopores; the interspaces sometimes solid, the mesopores en closed by a deposit of horizontally laminated calcareous

e: *Intrapora puteolata* Hall. Devonian, Mississippian. ies.

COSCINELLA Hall.

an explanate frond, of anastomosing branches, from a base; zoœcia tubular, resting upon the mesotheca, with g, direct vestibules; spaces between the vestibules and the the fenestrules occupied by numerous tabulated mesopores, pon the surface as minute angular pits; apertures circular, y disposed.

e: *Coscinella elegantula* Hall and Simpson. Devonian. Two

TÆNIODICTYA Ulrich.

ramose, rising from a basal expansion; branches rather ompressed; zoœcia short, tubular, oblong, both hemisepta rifices subcircular, at bottom of a sloping vestibular area; s ridgelike.

pe: *Tæniodictya ramulosa* Ulrich. Devonian, Mississippian. cies.

STICTOPORA Hall.

ramose; zoœcial tubes long, without hemisepta; apertures inct peristomes; interspaces wide, sometimes with raised

pe: *Stictopora elegantula* Hall. Ordovician.

HELIOTRYPA Ulrich.

bifoliate; zoœcia subtubular, thin-walled, and prostrate mesotheca, superior hemiseptum moderately developed; vesith thick walls, traversed obliquely by radially arranged buli; spaces between vestibules of variable width, occupied by numerous, irregular, thick-walled, tabulated mesopores, which are also clustered at intervals into maculæ; orifices circular, at the bottom of the sloping vestibule.

Genotype and only known species: *Heliotrypa bifolia* Ulrich. Mississippian.

Family **RHINIDICTYONIDÆ** Ulrich.

Zoarium bifoliate, continuous or jointed, consisting of compressed branches or leaf-like expansions; occasionally trifoliate; zooecia subquadrate, arranged longitudinally, inferior hemiseptum wanting; orifices and apertures elliptical or subcircular, sometimes a little truncated posteriorly; median tubuli between the median laminæ and between the longitudinal rows of zooecia; mesopores wanting, but vesicular tissue often developed.

RHINIDICTYA Ulrich.

Zoarium ramose, consisting of narrow, compressed, bifurcating, straight-edged branches with parallel margins, attached to foreign bodies by a continuous expanded base; apertures in longitudinal series between slightly elevated or flexuous ridges, carrying a crowded row of small blunt spines; space immediately surrounding the apertures sloping up to the summits of the ridges.

Genotype: *Rhinidictya nicholsoni* Ulrich. Ordovician. Nineteen species.

EURYDICTYA Ulrich.

Zoarium a broad, simple or irregularly divided, bifoliate expansion; surface with more or less conspicuous, small, solid maculæ or monticules; structure otherwise about as in Rhinidictya.

Genotype: *Eurydictya montifera* Ulrich. Ordovician. Four species.

PACHYDICTYA Ulrich.

Zoarium ramose, of narrow bifurcating stipes, with parallel margins, or irregular undulating fronds, with acute, nonporiferous margins; surface with small maculæ, surrounded by apertures slightly larger than the average; sometimes the marginal rows of apertures are also slightly larger than the average; zooecia with thin walls, elliptical or subquadrate in shape, separated from adjoining zooecia by small vesicles; vestibules direct, walls thickened and appearing ringlike in sections; spaces between vestibules traversed by one or more series of minute tubuli; one or more diaphragms developed; apertures commonly elliptical; interspaces usually forming a peristome about the apertures.

Genotype: *Pachydictya robusta* Ulrich. Ordovician, Silurian. Twenty-five described and several new species.

PHYLLODICTYA Ulrich.

m simple or irregularly branched, growing from an expanded
ıchment; zoœcia long, tubular, with diaphragms but no hemi-
nding very gradually outward from the central axis, thus
he apertures to be more or less strongly oblique, with the
edge liplike; interspaces wide, subsolid, traversed vertically
r two rows of minute tubuli, which appear as papillæ at the

rpe: *Phyllodictya frondosa* Ulrich. Ordovician. Two spe-

EUSPILOPORA Ulrich.

n consisting of small, irregularly divided branches, with ser-
wavy edges; apertures in four or more linear series on the
f the branch, between slightly elevated longitudinal ridges
numerous small nodes; alternately on the two sides are short
cted obliquely upward; between the ends of the zoœcia shal-
cular vesicles are found; interspaces traversed vertically by
s minute tubuli.
rpe: *Euspilopora serrata* Ulrich. Devonian. Four species.

DICRANOPORA Ulrich.

n jointed; segments ligulate, rarely simple, usually bifurcat-
e upper end; each extremity somewhat thickened; minute
of zoœcia and arrangement of apertures as in Rhinidictya.
rpe: *Ptilodictya internodia* Miller and Dyer. Ordovician,
Five species.

GONIOTRYPA Ulrich.

n with a prominent median ridge upon both sides of the
aved segments; otherwise like Dicranopora.
rpe and only known species: *Goniotrypa bilateralis* Ulrich.
n.

TRIGONODICTYA Ulrich.

n of triangular branches, constructed upon the plan of Pris-
but with zoœcia and all minute details of structure as in
tya.
rpe: *Trigonodictya conciliatrix* Ulrich. Ordovician, Silurian.
ribed and two new species.

Family CYSTODICTYONIDÆ Ulrich.

n consisting of two or three layers of cells grown together
back, forming branching, fenestruled, or entire leaf-like

expansions or triangular branches; zoœcia semicordate or obovate-acuminate in outline, arranged longitudinally; orifices subcircular, vestibule elongated; apertures with peristome and more or less well-developed lunarium; interzoœcial spaces occupied by vesicular tissue, often filled with a calcareous deposit near the surface.

CYSTODICTYA Ulrich (ARCANOPORA Vine, STICTOCELLA Simpson).

Zoarium ramose, branches sharply elliptical in cross section, with subparallel, nonporiferous margins; apertures subelliptical, in linear series between longitudinal ridges, which may not always be present, lunarium on the side of the aperture nearest the margin of the branch; interspaces finely striated, granulose or smooth; pits and cells show only in a worn condition.

Genotype: *Cystodictya ocellata* Ulrich. Range, Devonian–Carboniferous. Thirty-five species.

DICHOTRYPA Ulrich.

Zoarium a large, thin, bifoliate expansion; surface with solid maculæ; otherwise as in Cystodictya.

Genotype: *Dichotrypa foliata* Ulrich. Devonian, Mississippian. Seven species.

COSCINIUM Keyserling (COSCINOTRYPA Hall and Simpson).

Zoarium of flattened branches, celluliferous on both sides, which inosculate at short intervals till there is produced a broad frond, perforated at rythmical intervals by circular or elliptical fenestrules; in other respects like Cystodictya.

Genotype: *Coscinium cyclops* Keyserling. Range, Devonian–Carboniferous. Five species.

TÆNIOPORA Nicholson (PTEROPORA Hall, STICTOPORIDRA Simpson).

Zoarium with a strongly elevated longitudinal central ridge on each face, so that a cross section of the branches is somewhat rhomboidal; otherwise like Cystodictya.

Genotype: *Tæniopora exigua* Nicholson. Devonian. Five species.

THAMNOTRYPA Hall (Thamnopora Hall).

> Zoarium consisting of a very narrow stipe, from which proceed rectangularly lateral branches; celluliferous on each face; cell apertures oval; usually disposed in two parallel longitudinal rows, separated by a prominent ridge. Sometimes three rows occur and occasionally four rows for a short distance on the stipe. On the lateral branches there are never more than two rows.[1]

Genotype and only known species: *Thamnopora divaricata* Hall. Devonian.

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[1] Simpson, Fourteenth Ann. Rep. State Geologist New York for the year 1894, p. 546.

SEMIOPORA Hall.

m a flattened, bifurcating frond, proceeding from a spread-
; branches narrow, with parallel margins and a narrow non-
ous marginal space; interzoœcial spaces occupied by vesicular
pertures oval or subcircular, regularly disposed in parallel
inal rows; apertures largest in marginal rows; between the
s in a longitudinal direction are the openings of two small
es side by side.
ype and only known species: *Semiopora bistigmata* Hall.
n.

PTILOCELLA Simpson.

m ensiform, with a pointed, striated base; apertures circular,
in parallel, longitudinal rows, separated by ridges; margins
striated, non-celluliferous.
ype and only known species: *Ptilodictya parallela* Hall. Devo-

ACROGENIA Hall.

m segmented, arising from cylindrical rootlets; two segments
rom the truncated termination of the proceeding one; segments
l and striated at the base, gradually becoming flattened and
apertures; apertures largest in the marginal rows, with prom-
arium, in linear series separated by ridges.
ype and only known species: *Acrogenia prolifera* Hall. Devo-

PRISMOPORA Hall.

m ramose, of triangular, bifurcating or trifurcating branches,
es anastomosing and forming clumps; branches with the sides
, usually a little concave, edges sharp, sometimes serrated or
œcia arise from mesothecæ which radiate from the center to
gins; apertures varying in arrangement, sometimes on the
of small papillæ; structure otherwise as given for the family.
ype: *Prismopora triquetra* Hall. Range, Devonian-Carbon-
Nine species.

SCALARIPORA Hall.

m with the faces of the triangular branches crossed by salient
e ridges; otherwise like Prismopora.
ype: *Scalaripora scalariformis* Hall. Devonian. Five species.

GLYPTOPORA Ulrich.

m a thin expansion, traversed on both surfaces by salient
r crests, uniting so as to form larger or smaller cup-shaped

cavities; or a unilaminate base on which the ridges are greatly developed and form large leaves; these ridges or leaves are composed of two layers of zoœcia growing in opposite directions from a mesotheca; in the angles of each cup is a depressed noncelluliferous furrow which with similar furrows in neighboring cups produces a thin junction between the leaves; surface of the ridges and of the cups with elongated solid maculæ or "dimples;" structure otherwise as given for the family.

Genotype: *Coscinium plumosum* Prout. Mississippian. Eight species.

PHRACTOPORA Hall.

Like Glyptopora except that the apertures are relatively more rounded and larger, and the junction angles are celluliferous and thicker than any other part of the leaves.

Genotype: *Phractopora cristata* Hall. Devonian, Mississippian. Four species.

CERAMELLA Hall.

> Zoarium consisting of thin, foliaceous expansions, arising from a spreading base; celluliferous on each face; cells tubular, oblique; cell apertures oval or circular, disposed in quincunx order; surface marked by sterile maculæ, which are usually depressed below the general surface of the branch.[1]

Genotype and only known species: *Ceramella scidacea* Hall. Devonian.

EVACTINOPORA Meek and Worthen.

Zoarium free, consisting of four or more vertical leaves, arranged in a cruciform or stellate manner; rays free in the upper half, united, thick, and nonporiferous in the basal portion; apertures on both faces of the leaves or rays, subcircular; interspaces solid at the surface, occupied by vesicular tissue internally.

Genotype: *Evactinopora radiata* Meek and Worthen. Mississippian. Four species.

GONIOCLADIA Etheridge, Jun. (CARINELLA Etheridge, Jun.).

Family **ACTINOTRYPIDÆ** Ulrich

ACTINOTRYPA Ulrich.

Zoarium a thin bifoliate expansion; apertures show the projecting ends of from eight to ten vertical septa-like ridges that extend down along the sides of the vestibule nearly or quite to the orifice.

Genotype and only known species: *Fistulipora peculiaris* Rominger. Mississippian.

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[1] Simpson, Fourteenth Ann. Rep. State Geologist New York for the year 1894, p. 527.

Family CYCLOPORIDÆ.

CYCLOPORA Prout.

m unilaminar, parasitic or free; zoœcia subtubular, hemisepta or but little developed; vestibules with rather thick walls; the vestibules are mesopores crossed by thick diaphragms, ually have a central perforation and are open at the surface; subcircular, with a smooth or granulose peristome; acan- sometimes present.

ype: *Cyclopora fungia* Prout. Mississippian. Two species.

CYCLOPORELLA Ulrich.

m a thin discoidal expansion; zoœcia subtubular; vestibules ıccession of superior hemisepta; irregular mesopores abun- merous acanthopores of large size.

ype: *Cycloporella spinifera* Ulrich. Mississippian. Two

PROUTELLA Ulrich.

m discoid, thin, free, under surface with a concentrically epitheca; zoœcia subtubular, thin-walled; apertures broad- ; surrounded by a narrow sloping area, hexagonal in outline; rfect the apertures have a depressed calcareous plate that ittle less than two-thirds of the opening, the orifice left being gular in form, without thickened margins, and situated at the side; with age the vestibules become elongated and are inter- incomplete diaphragms.

ype and only known species: *Cyclopora discoidea* Prout. Mis- ı.

WORTHENOPORA Ulrich.

m bifoliate, branching or palmate; zoœcia very regularly , elongate rhomboidal; apertures semielliptical, the truncated margin somewhat raised; on the surface the line of junction adjoining zoœcia is marked by an elevated ridge; the elongate r space below the apertures perfectly plain.

ype: *Worthenopora spinosa* Ulrich. Mississippian. Two species.

Family RHINOPORIDÆ Ulrich.

m variable in form; zoœcia prone along the basal membrane, blong, or rhomboidal; vestibules direct, hemisepta wanting t so; front of zoœcia below vestibule commonly strengthened d or vesicular tissue.

RHINOPORA Hall.

Zoarium forming large, undulating bifoliate expansions, cel on both sides; surface usually smooth, rarely with solid m and traversed by slender, rounding, bifurcating ridges, whi as shallow grooves when the surface is worn; apertures nearl occupying the summits of prominent papillæ; mesopores pr closed at the surface; large median tubuli in the mesotheca.

Genotype: *Rhinopora verrucosa* Hall. Silurian. Three s

DIAMESOPORA Hall.

Zoarium ramose, of hollow stems lined internally by an zoœcia simple, hexagonal, or rhomboidal, with an oval ori anterior half, which with growth forms a tubular vestibule; with peristomes equally elevated or highest posteriorly; int lar spaces compact or horizontally laminated.

Genotype: *Diamesopora dichotoma* Hall. Silurian. Five

LICHENALIA Hall.

Zoarium a subcircular unilaminar expansion; zoœcia elongate-subrhomboidal, with direct subtubular vestibules; rounded, with peristome much elevated on the posterior si spaces depressed, ? cellulose.

Genotype and only known species: *Lichenalia concent* Silurian.

STICTOTRYPA Ulrich.

Zoarium ramose, not pointed at the base; branches dich dividing, narrow, compressed; apertures circular or ellipt distinct, evenly elevated peristome; interspaces flat or conc posed of horizontally laminated solid tissue.

Genotype: *Stictopora similis* Hall. Silurian. Three spe

Suborder CHILOSTOMATA Busk.

Zoœcia oval, turbinate, urceolate, quadrate, or hexagonal, usually side by side; orifice more or less anterior, of less dia the zoœcium, closed by a movable cover; ova commonly m external marsupia: appendicular organs frequently present.

Family PALESCHARIDÆ Ulrich.

PALESCHARA Hall.

Zoarium forming thin incrustations upon Orthocerata organisms; zoœcia very short, direct, with thin walls; ape such they can be called) long hexagonal or polygonal.

Genotype: *Paleschara incrustans* Hall. Range, Ordovic nian. Thirteen species.

FOREIGN GENERA.

ber of generic terms, founded for species occurring in Euro-
eozoic deposits, have been proposed in European publications,
not found their way into American literature. A list of
ubjoined, though it is scarcely probable that the list is com-
considerable number of these generic terms appeared before
ts had begun to feel the necessity for precise and complete
s and descriptions, so that it is not possible to fit them into
ent classification. When the material is examined upon which
e based, most of these early genera will be found to occupy
ground as genera founded much later and now in current use.
any of the genera listed below have received a second treat-
that nothing has been added to the original unsatisfactory
ons. We have thought that it might not be amiss to hazard a
sed on descriptions and figures, both commonly lacking defi-
as to what these genera may prove to be.

ACANTHOPORA Young and Young.

a Young and Young, Proc. Nat. Hist. Soc. Glasgow, II, 1875, p. 327; Vine,
orkshire Geol. Polyt. Soc., IX, 1885, p. 83. Genotype: *Glauconome* (*Acan-*
) *stellipora* Young and Young, Proc. Nat. Hist. Soc. Glasgow, II, 1875, p.
iv, 25, 26.

bgenus seems to be based upon the perfect condition of the
of *Pinnatopora*, a feature of not even specific importance.
, the name would drop anyway, as it was used by D'Orbigny,
Pal., I, 1850, p. 318.

AMORPHOTRYPA Whidborne.

pa Whidborne, Devonian Fauna England, II, Part 4, 1895, p. 181 (Pal. Soc.
XLIX). Genotype: *Isotrypa? Gregorii* Whidborne, loc. cit., p. 181, pl.
e.

nus, whose structure can not be said to be fully understood
eems closely related to *Isotrypa*. It is a member of the
idæ.

ARCHÆOPORA Eichwald.

Eichwald, Lethæa Rossica, I, 1860, p. 405.

pecies are given by Eichwald under this genus, which appears
some of the ground, at least, which is now included in *Callo-*
.

CHASMATOPORA Eichwald.

ra Eichwald, Lethæa Rossica, I, 1860, p. 370. Only species given: *C. ten-*
hwald, loc. cit., p. 371.

pears to be a *Phylloporina*.

DIPHTHEROPORA De Koninck.

Diphtheropora De Koninck, Recherches sur les Animaux Fossiles, part 2, 187
Genotype (only species): *D. regularis* De Koninck, loc. cit., p. 13, pl. i, 4.

This is almost certainly an *Eridopora.*

DISTEICHIA Sharpe.

Disteichia Sharpe, Quar. Jour. Geol. Soc. London, IX, 1853, p. 146. Only
D. reticulata Sharpe, loc. cit., p. 146, pl. vii, 8 a–d.

This appears to be a synonym for *Clathropora* Hall

FILITES (Barrande) Počta.

Filites (Barrande) Počta, Système Silurien Bohême, VIII, tome 1, 1894,
Genotype: *F. cribrosus* Počta, loc. cit., p. 110, pl. x, 19–25.

This appears to be a type not yet discovered in American str

LEMMATOPORA Počta.

Lemmatopora Počta, Système Silurien Bohême, VIII, tome 1, 1894, p. 102. Ge
L. angulosa Počta, loc. cit., p. 105, pl. ii, 20–21.

This genus as described seems in part equivalent to *Sticto*
Ulrich, but probably includes forms referable to other genera.

MASTOPORA Eichwald.

Mastopora Eichwald, Lethæa Rossica, I, 1860, p. 434. Only species: *M.*
Eichwald, loc. cit., p. 434, pl. xxvii, 7 a–d.

This may be related to *Rhinopora* Hall.

MICROPORA Eichwald.

Micropora Eichwald, Lethæa Rossica, I, 1860, p. 393.

Three species are given, *M. gracilis* Eichwald, *M. cyclosto*
M. rhombica. May be *Stictoporella*, or perhaps *Clathropora.*

MYRIOLITHES Eichwald.

Myriolithes Eichwald, Lethæa Rossica, I, 1860, p. 450.

Four species are cited; probably monticuliporoids.

PTEROPORA Eichwald.

Pteropora Eichwald, Lethæa Rossica, I, 1860, p. 395.

Two species, *P. pennula* and *P. exilis*, are given. Eichwald s
genus is related to *Ichthyorachis* McCoy.

RHABDINOPORA Eichwald.

nopora Eichwald, Lethæa Rossica, I, 1860, p. 368.

o species, *R. flabelliformis* Eichwald and *R. undulata* Eichwald, iven. Seems to be a fenestellid with one row of cells to the h; this is a type unknown to us, unless it be a case of defective vation.

SERIOPORA Počta.

ra Počta, Système Silurien Bohême, VIII, tome 1, 1894, p. 78. Genotype: *petala* Počta, loc. cit., p. 79, pl. xiii, 8–12.

ta has undoubtedly wrongly interpreted D'Orbigny's genus *Rete-a*, which was based on Goldfuss's *Retepora prisca*. Počta's *Serio-*s the *Reteporina* of D'Orbigny, as interpreted by Simpson and give it; Počta's *Reteporina* (loc. cit., p. 80) appears to be in *Fenestella* and perhaps, in part, another as yet unnamed genus of enestellidæ.

SULCORETEPORA D'Orbigny.

tepora D'Orbigny, Prodr. de Pal., I, 1850, p. 152.

s genus was based upon *Flustra parallela* Phillips, 1833. The tion given is too meager for recognition. The *Flustra parallela* illips is now considered to be a *Cystodictya*.

UTROPORA Počta.

a Počta, Système Silurien Bohême, VIII, tome 1, 1894, p. 75. Genotype: *nobilis* (Barrande) Počta, loc. cit., p. 76, pl. xvii, 4–17.

e *Fenestella*, but differs chiefly in having very much elongated rules (6 by 1 mms.) and in lacking a median keel.

LIST OF GENERA, SHOWING SYSTEMATIC POSITION.

Genus.	Family.	Suborder.
ocladia King.	Acanthocladiidæ.	Cryptostomata.
oclema Hall.	Rhabdomesontidæ.	Cryptostomata.
nia Hall.	Cystodictyonidæ.	Cryptostomata.
trypa Ulrich.	Actinotrypidæ.	Cryptostomata.
xopora Ulrich.	Amplexoporidæ.	Trepostomata.
rypa Ulrich.	Batostomellidæ.	Trepostomata.
ichia Ulrich.	Ceramoporidæ.	Cyclostomata.
edes Owen.	Fenestellidæ.	Cryptostomata.
clema Billings.	Arthrostylidæ.	Cryptostomata.
pora Ulrich.	Ptilodictyonidæ.	Cryptostomata.
stylus Ulrich.	Arthrostylidæ.	Cryptostomata.
ctyon Nicholson and ridge Jun.	Ascodictyonidæ.	Ctenostomata.
pora Ulrich.	Monticuliporidæ.	Trepostomata.
pora Ulrich.	Heterotrypidæ.	Trepostomata.

Genus.	Family.	Suborder.
Atactoporella Ulrich.	Monticuliporidæ.	Trepostomata.
Bactropora Hall.	Rhabdomesontidæ.	Cryptostomata.
Batostoma Ulrich.	Trematoporidæ.	Trepostomata.
Batostomella Ulrich.	Batostomellidæ.	Trepostomata.
Berenicea Lamouroux.	Diastoporidæ.	Cyclostomata.
Botryllopora Nicholson.	Botrylloporidæ.	Cyclostomata.
Buskopora Ulrich.	Fistuliporidæ.	Cyclostomata.
Bythopora Miller and Dyer.	Batostomellidæ.	Trepostomata.
Bythotrypa Ulrich.	Ceramoporidæ.	Cyclostomata.
Callopora Hall.	Calloporidæ.	Trepostomata.
Calloporella Ulrich.	Calloporidæ.	Trepostomata.
Callotrypa Hall.	Batostomellidæ.	Trepostomata.
Ceramella Hall.	Cystodictyonidæ.	Cryptostomata.
Ceramophylla Ulrich.	Ceramoporidæ.	Cyclostomata.
Ceramopora Hall.	Ceramoporidæ.	Cyclostomata.
Ceramoporella Ulrich.	Ceramoporidæ.	Cyclostomata.
Chainodictyon Foerste.	Chainodictyonidæ.	Cryptostomata.
Chiloporella Ulrich.	Ceramoporidæ.	Cyclostomata.
Chilotrypa Ulrich.	Fistuliporidæ.	Cyclostomata.
Clathropora Hall.	Ptilodictyonidæ.	Cryptostomata.
Clonopora Hall.	Entalophoridæ.	Cyclostomata.
Cœlocaulis Hall.	Fistuliporidæ.	Cyclostomata.
Cœloclema Ulrich.	Ceramoporidæ.	Cyclostomata.
Cœloconus Ulrich.	Rhabdomesontidæ.	Cryptostomata.
Constellaria Dana.	Constellariidæ.	Trepostomata.
Coscinella Hall.	Stictoporellidæ.	Cryptostomata.
Coscinium Keyserling.	Cystodictyonidæ.	Cryptostomata.
Crepipora Ulrich.	Ceramoporidæ.	Cyclostomata.
Crisinella Hall.	Idmoneidæ.	Cyclostomata.
Cyclopora Prout.	Cycloporidæ.	Cryptostomata.
Cycloporella Ulrich.	Cycloporidæ.	Cryptostomata.
Cyclotrypa Ulrich.	Fistuliporidæ.	Cyclostomata.
Cystodictya Ulrich.	Cystodictyonidæ.	Cryptostomata.
Cystopora Hall.	Entalophoridæ.	Cyclostomata.
Dekayella Ulrich.	Heterotrypidæ.	Trepostomata.
Dekayia Milne-Edwards and Haime.	Heterotrypidæ.	Trepostomata.
Diamesopora Hall.	Rhinoporidæ.	Cryptostomata.
Diastoporina Ulrich.	Diastoporidæ.	Cyclostomata.
Dichotrypa Ulrich.	Cystodictyonidæ.	Cryptostomata.
Dicranopora Ulrich.	Rhinidictyonidæ.	Cryptostomata.
Diploclema Ulrich.	Entalophoridæ.	Cyclostomata.
Diploporaria.	Acanthocladiidæ.	Cryptostomata.
Diplotrypa Nicholson.	Trematoporidæ.	Trepostomata.
Discotrypa Ulrich.	Amplexoporidæ.	Trepostomata.
Dittopora Dybowski.	Constellariidæ.	Trepostomata.
Drymotrypa Ulrich.	Phylloporinidæ,	Cryptostomata.
Eridopora Ulrich.	Fistuliporidæ.	Cyclostomata.
Eridotrypa Ulrich.	Batostomellidæ.	Trepostomata.
Escharopora Hall.	Ptilodictyonidæ.	Cryptostomata.
Eurydictya Ulrich.	Rhinidictyonidæ.	Cryptostomata.
Euspilopora Ulrich.	Rhinidictyonidæ.	Cryptostomata.

Genus.	Family.	Suborder.
ora Meek and n.	Cystodictyonidæ.	Cryptostomata.
Hall.	Fistuliporidæ.	Cyclostomata.
Lonsdale.	Fenestellidæ.	Cryptostomata.
a Prout.	Fenestellidæ.	Cryptostomata.
ora Hall.	Fenestellidæ.	Cryptostomata.
a McCoy.	Fistuliporidæ.	Cyclostomata.
pa Hall.	Fistuliporidæ.	Cyclostomata.
a Ulrich.	Cystodictyonidæ.	Cryptostomata.
ia Etheridge,	Cystodictyonidæ.	Cryptostomata.
a Ulrich.	Rhinidictyonidæ.	Cryptostomata.
tya Ulrich.	Ptilodictyonidæ.	Cryptostomata.
Hall.	Diastoporidæ.	Cyclostomata.
a Claypole.	Fenestellidæ.	Cryptostomata.
a Ulrich.	Stictoporellidæ.	Cryptostomata.
Hall.	Arthrostylidæ.	Cryptostomata.
gma Ulrich.	Trematoporidæ.	Trepostomata.
a Phillips.	Fenestellidæ.	Cryptostomata.
Hall.	Diastoporidæ.	Cyclostomata.
pa Nicholson.	Heterotrypidæ.	Trepostomata.
lla Waagen and l.	Fistuliporidæ.	Cyclostomata.
pa Ulrich.	Monticuliporidæ.	Trepostomata.
ella Ulrich.	Monticuliporidæ.	Trepostomata.
opora Etheridge,	Rhabdomesontidæ.	Cryptostomata.
chis McCoy.	Acanthocladiidæ.	Cryptostomata.
Ulrich.	Constellariidæ.	Trepostomata.
Hall.	Stictoporellidæ.	Cryptostomata.
Hall.	Fenestellidæ.	Cryptostomata.
a Ulrich.	Heterotrypidæ.	Trepostomata.
Hall.	Rhinoporidæ.	Cryptostomata.
ypa Ulrich.	Fistuliporidæ.	Cyclostomata.
Ulrich.	Batostomellidæ.	Trepostomata.
la Foerste.	Batostomellidæ.	Trepostomata.
a Hall.	Fenestellidæ.	Cryptostomata.
Hall.	Fenestellidæ.	Cryptostomata.
a Ulrich.	Fistuliporidæ.	Cyclostomata.
Ulrich.	Monticuliporidæ.	Trepostomata.
Ulrich.	Entalophoridæ.	Cyclostomata.
a Nicholson.	Trematoporidæ.	Trepostomata.
ella Ulrich.	Amplexoporidæ.	Trepostomata.
pora D'Orbigny.	Monticuliporidæ.	Trepostomata.
s Hall.	Rhabdomesontidæ.	Cryptostomata.
ra Ulrich.	Arthrostylidæ.	Cryptostomata.
ella Ulrich.	Constellariidæ.	Trepostomata.
Eichwald.	Heterotrypidæ.	Trepostomata.
Hall.	Rhabdomesontidæ.	Cryptostomata.
ya Ulrich.	Rhinidictyonidæ.	Cryptostomata.
a Hall.	Palescharidæ.	Chilostomata.
ra Nicholson.	Monticuliporidæ.	Trepostomata.
pa Ulrich.	Amplexoporidæ.	Trepostomata.

Genus.	Family.	Suborder.
Petigopora Ulrich.	Heterotrypidæ.	Trepostomata.
Phacelopora Ulrich.	Phaceloporidæ.	Cyclostomata.
Phænopora Hall.	Ptilodictyonidæ.	Cryptostomata.
Phractopora Hall.	Cystodictyonidæ.	Cryptostomata.
Phyllodictya Ulrich.	Rhinidictyonidae.	Cryptostomata.
Phyllopora King.	Fenestellidæ.	Cryptostomata.
Phylloporina Ulrich.	Phylloporinidae.	Cryptostomata.
Pinacotrypa Ulrich.	Fistuliporidæ.	Cyclostomata.
Pinnatopora Vine.	Acanthocladiidæ,	Cryptostomata.
Polypora McCoy.	Fenestellidæ.	Cryptostomata.
Prasopora Nicholson and Etheridge Jun.	Monticuliporidæ.	Trepostomata.
Prismopora Hall.	Cystodictyonidæ.	Cryptostomata.
Proboscina Audouin.	Diastoporidæ.	Cyclostomata.
Protocrisina Ulrich.	Idmoneidæ.	Cyclostomata.
Proutella Ulrich.	Cycloporidæ.	Cryptostomata.
Ptilocella Simpson.	Cystodictyonidæ.	Cryptostomata.
Ptilodictya Lonsdale.	Ptilodictyonidæ.	Cryptostomata.
Ptilopora McCoy.	Acanthocladiidæ.	Cryptostomata.
Ptiloporella Hall.	Fenestellidæ.	Cryptostomata.
Ptiloporina Hall.	Fenestellidæ.	Cryptostomata.
Ptilotrypa Ulrich.	Stictoporellidæ.	Cryptostomata.
Ramipora Toula.	Acanthocladiidæ.	Cryptostomata.
Reteporidra.	Fenestellidæ.	Cryptostomata.
Reteporina D'Orbigny.	Fenestellidæ.	Cryptostomata.
Reptaria Rolle.	Diastoporidæ.	Cyclostomata.
Rhabdomeson Young and Young.	Rhabdomesontidæ.	Cryptostomata.
Rhinidictya Ulrich.	Rhinidictyonidæ.	Cryptostomata.
Rhinopora Hall.	Rhinoporidæ.	Cryptostomata.
Rhombopora Meek.	Rhabdomesontidæ.	Cryptostomata.
Rhopalonaria Ulrich.	Rhopalonariidæ.	Ctenostomata.
Scalaripora Hall.	Cystodictyonidæ.	Cryptostomata.
Scenellopora Ulrich.	Ceramoporidæ.	Cyclostomata.
Sceptropora Ulrich.	Arthrostylidæ.	Cryptostomata.
Selenopora Hall.	Fistuliporidæ.	Cyclostomata.
Semicoscinium Prout.	Fenestellidæ.	Cryptostomata.
Semiopora Hall.	Cystodictyonidæ.	Cryptostomata.
Septopora Prout.	Acanthocladiidæ.	Cryptostomata.
Spatiopora Ulrich.	Ceramoporidæ.	Cyclostomata.
Sphragiopora Ulrich.	Sphragioporidæ.	Cryptostomata.
Stellipora Hall.	Constellariidæ.	Trepostomata.
Stenopora Lonsdale.	Batostomellidæ.	Trepostomata.
Stictopora Hall.	Stictoporellidæ.	Cryptostomata.
Stictoporella Ulrich.	Stictoporellidæ.	Cryptostomata.
Stictoporina Hall and Simpson.	Ptilodictyonidæ.	Cryptostomata.
Stictotrypa Ulrich.	Rhinoporidæ.	Cryptostomata.
Stomatopora Bronn.	Diastoporidæ.	Cyclostomata.
Streblotrypa Ulrich.	Rhabdomesontidæ.	Cryptostomata.
Stromatotrypa Ulrich.	Trematoporidæ.	Trepostomata.
Strotopora Ulrich.	Fistuliporidæ.	Cyclostomata.
Synocladia King.	Acanthocladiidæ.	Cryptostomata.

Genus.	Family.	Suborder.
ctya Ulrich.	Stictoporellidæ.	Cryptostomata.
ra Nicholson.	Cystodictyonidæ.	Cryptostomata.
igma Hall.	Batostomellidæ.	Trepostomata.
scus King.	Fenestellidæ.	Cryptostomata.
trypa Hall.	Cystodictyonidæ.	Cryptostomata.
lla Hall.	Batostomellidæ.	Trepostomata.
pora Hall.	Trematoporidæ.	Trepostomata.
dictya Ulrich.	Rhinidictyonidæ.	Cryptostomata.
pora Hall.	Rhabdomesontidæ.	Cryptostomata.
a Hall.	Fenestellidæ.	Cryptostomata.
Ulrich.	Ascodictyonidæ.	Ctenostomata.*
opora Ulrich.	Cycloporidæ.	Cryptostomata.

LIST OF INVALID GENERIC NAMES.

stoma Young and Young=Fenestella Lonsdale.
Lamouroux (preoccupied). Now Stomatopora Bronn.
omopora Simpson=Reteporidra.
opora Vine=Cystodictya Ulrich.
medipora D'Orbigny=Archimedes Owen.
nema Ulrich (preoccupied). Now Arthrostylus Ulrich.
lla Etheridge, Jun. Now Goniocladia Etheridge, Jun.
pora Nicholson=Semicoscinium Prout.
otrypa Hall and Simpson=Coscinium Keyserling.
pora Nicholson=Semicoscinium Prout.
orina Simpson=Semicoscinium Prout.
icopora De Koninck=Ptilopora McCoy.
lites Eichwald.
pora of authors (not Lamouroux)=Berenicea Lamouroux.
porella Vine=Berenicea Lamouroux.
nopora Ulrich=Fistulipora McCoy.
ora Young and Young=Diploporaria.
wskia Waagen and Pichl=Fistulipora McCoy.
wskiella Waagen and Pichl=Fistulipora McCoy.
pora D'Orbigny. Not recognized.
trellina D'Orbigny. Not recognized.
icella Simpson=Pinacotrypa Ulrich.
iporella Simpson=Fistulipora McCoy.
iporidra Simpson=Favicella Hall.
iporina Simpson=Pinacotrypa Ulrich.
liporella Simpson=Polypora McCoy.
liporina Simpson=Fenestella Lonsdale.
zella Waagen and Wentzel=Batostomella Ulrich.
onome of authors (not Goldfuss)=Pinnatopora Vine.
dictya Nicholson=Ptilodictya Lonsdale.
alia Hall (in part)=Fistulipora McCoy.
orella Simpson=Lyropora Hall.
oridra Simpson=Lyropora Hall.
orina Simpson=Lyropora Hall.
ipora McCoy. Not recognized.
lsonia Davis=Hederella Hall.
lsonia Waagen and Wentzel=Escharopora Hall.
otrypa Hall=Buskopora Ulrich.

Omniretepora D'Orbigny. Not recognized.
Orbitulites Eichwald (preoccupied). Now Orbipora Eichwald.
Penniretepora D'Orbigny. Not recognized.
Pileotrypa Hall=Eridopora Ulrich.
Pinnaporella Simpson (1895)=Ptiloporina Hall.
Pinnaporella Simpson (1897)=Ptiloporella Hall.
Pinnaporina Simpson=Ptiloporina Hall.
Polyporella Simpson=Polypora McCoy.
Protoretepora De Koninck=Polypora McCoy.
Pteropora Hall=Tæniopora Nicholson.
Ptilionella Hall=Reptaria Rolle.
Ptychonema Hall and Simpson=Monotrypa Nicholson.
Reteporella Simpson=Reteporidra.
Rosacilla Roemer=Berenicea Lamouroux.
Sagenella Hall=Berenicea Lamouroux.
Stictocella Simpson=Cystodictya Ulrich.
Stictoporidra Simpson=Tæniopora Nicholson.
Subretepora D'Orbigny. Not recognized.
Tabulipora Young=Stenopora Lonsdale.
Tectulipora Hall=Loculipora Hall.
Tectuliporella Simpson=Isotrypa Hall.
Thamnocella Simpson=Drymotrypa Ulrich.
Thamnopora Hall (preoccupied). Now Thamnotrypa Hall.
Tubuliclidia Lonsdale=Stenopora Lonsdale.

DISTRIBUTION.

GEOGRAPHIC DISTRIBUTION

The most favored part of the earth for reading Paleozoic hist the continent of North America. On this continent the deposit sediments proceeded under such fortunate conditions in the Pal ages and the sediments have since been so little disturbed that the cession is easily made out. A large inland sea occupied the interior continent flanked on the east and west by more or less continuin riers. The wide area of this sea, coupled with its comparative sh ness, provided conditions highly favorable for an abundant marin and especially for bryozoa. In the region of the eastern barrie the eastern highland of the continent, judging from the fossil re hitherto made known, the conditions were often, perhaps gene unfavorable for bryozoan life and only locally are the remains c class found in the Paleozoic rocks of the Appalachian region; b wide sea stretching for a thousand or more miles westward fro eastern barrier, gradually filling with the detritus from the e formed or primeval rocks, supported a wealth of marine forms, a which the bryozoa formed a leading element.

The Eurasian land mass presents many surface exposures of Pal age, but they are to a greater or less extent disconnected. In A Salt Range of India has yielded Carboniferous bryozoa with its fossils. The region of the Ural Mountains, the regions bordering ltic Sea, England, and Scotland, contain most of the Paleozoic which have thus far yielded bryozoa. Three or four times as species have been made known from North America as from all t of the world.

earliest bryozoa, so far as we now know, are in the Chazy. re few in numbers, but this may be because they have not been atically collected and studied.

Trenton period, in all its subdivisions, Stones River (Birdseye), River, and Trenton proper (including the Galena), is a vast tomb ozoa. The seas seem to have swarmed with these minute crea- In eastern Canada and New York, thence stretching through o to the northwest into Wisconsin, Minnesota, and Manitoba, posits following roughly the outline of the northern or north- border of the interior sea. Deposits formed along what was appear as an island or islands—the Cincinnati anticline—are pen to our inspection in Kentucky and Tennessee. At isolated in Illinois and Missouri Trenton deposits are also exposed. solated tracts of early Silurian times are exposed in the western nd. The Trenton is preeminently a continental formation. ly anywhere between the two highlands does the drill fail to renton if sent deep enough.

succeeding period, the Cincinnati—by some authors still termed dson River group, though the name seems to be a misnomer— n a formation of continental extent, in which bryozoa flourished. posits in eastern New York along the Hudson River, supposedly age, have yielded no bryozoa and few other fossils. The Utica nd the Lorraine and Pulaski shales and sandstones in the region Mohawk Valley and southeast of Lake Ontario were formed conditions not generally propitious for bryozoa. But in the r, in the region of the Cincinnati anticline, conditions were con- and bryozoa flourished. Ohio, Kentucky, Indiana, and some l areas in Illinois, Minnesota, Wisconsin, and Iowa, all yield reserved bryozoa and usually in great abundance. Outcrops also in Canada and as far east as Anticosti Island, in the gulf of wrence.

Upper Silurian deposits in this country are exposed rather . Many of them were formed under conditions which precluded an life, but in some bryozoa are exceedingly abundant. From dina and Waterlime no bryozoa have been made known. The n has yielded a considerable number both in New York and in o, as well as around the borders of the Cincinnati anticline, but e seldom finely preserved. The Niagara deposits are generally aracter unfavorable to the preservation of its fauna, but there o good exceptions—an area in western New York, typically d at Lockport, and one in the vicinity of Waldron, Indiana.

The Lower Helderberg, succeeding the Niagara, is local in its d
tion. But its exposures in Albany and Schoharie counties, Ne
have yielded a large number of bryozoa, which, however,
favorably preserved for microscopic study. By some writ
Lower Helderberg is considered Devonian. Its bryozoan fau
cates relationship about equally with both Niagara and Upper
berg.

The Devonian age was ushered in by conditions unfavor
bryozoan life. The Onondaga and Saliferous have yielded no b
The Upper Helderberg, in a belt extending from eastern Ne
west into Ontario, has proved rather prolific. The succeeding
tion, the Hamilton, is preeminently a bryozoan epoch. In
New York, Ontario, Michigan, Manitoba, and Iowa its depo
characterized generally by an abundance of bryozoa in a good
preservation. A coral reef in the ancient sea, now formi
obstruction in the Ohio River at the Falls of the Ohio, afforde
pitable abode for immense numbers of bryozoa. The later
tions of the Devonian, best displayed in New York and Penns
have yielded very few bryozoa. None have yet been describe

For the early part of the Carboniferous age the name Missis
seems to be gradually displacing in this country the terms Sub
iferous and Lower Carboniferous, which have been so variou
that their use now produces ambiguity. The Mississippian
characterized in North America by limestone formations,
located in the Mississippi Valley, though deposits also occur
sharply differentiated, in the trough between the Cincinnati a
and the eastern highland, to which such local names as Waver
shall, and Maxville limestone have been applied. Being li
formations, they are, as might be expected, very prolific of b
some, however, much less so than others. The earlier formati
Kinderhook and Burlington, also have yielded but a limited nu
bryozoa, but this may be due to the comparatively limited
outcrop and to lack of systematic collecting.

In the Coal Measures conditions producing brackish or fres
and marine formations alternated irregularly. Naturally,
fossils are quite local in occurrence. But among the marin
bryozoa hold their place extremely well, though they are much
from the opulence of the Mississippian series in kinds and nu

By the close of the Coal Measures the interior sea had be
nigh effaced, and in the West and Southwest only—Kansas and
do we find Permian deposits of any considerable extent.
bryozoa are known from these deposits; whether this is due
absence or to lack of collecting we do not know.

During later geological times marine deposits in this cou
limited to the Atlantic and Gulf Coastal Plain, to a few favor

Great Plains and Rocky Mountain regions, and the territory ng the Pacific. Comparatively few bryozoa of later age have ade known, though the indications are that a large number of will be the reward of thorough collecting. In central and n Europe Mesozoic and Tertiary beds often abound in bryozoa.

GEOLOGIC DISTRIBUTION.

gh the materials for the history of the biologic and phylo- development of the Paleozoic bryozoa are to be found in the f the North American continent, scarcely a beginning has yet ade. Before this history can be written with any degree of ness, the preliminary work of collecting, studying, classifying, paring the faunas of successive formations must be well under This work is still in its infancy. The only worker in this field s yet cared to do any generalizing is Mr. E. O. Ulrich, and he ventured very far.

dy of the tables given farther on will afford some indications ich results which the future may be expected to bring. It is sible to use the numbers there given determinatively for gen- ions, for while the tables give the numbers of all species and thus far described and recognized as valid, there remains in collections, public and private, a very large number of unde- species and some new genera. Therefore, any conclusions pon the numbers in the tables can at best be merely tentative. yozoa have yet been known from the Cambrian, or the lowest)rdovician formations—the Calciferous. Whether this means y are actually absent, or that they are so rare as not yet to llen under collectors' eyes, can not be said. From the Chazy me the oldest unequivocal bryozoa, three species of Phyllopo- e of Rhinidictya, and one of Stictopora, all cryptostomatous with indications of the presence of some Trepostomata. It is e that future collecting will very much increase this meager ugh good localities seem to be rare.

e Trenton period the bryozoa occur in the greatest profusion. Chazy forms have multiplied, as if by magic, into the large fauna. One of the missing links in paleontological history s occurs at this point. The Trenton formation stands second umber of described species, though it will probably in the end Not less than 80 species are known that await description. The omata form half the fauna. The Cryptostomata rank next. ter soon became and continued the predominant type of the ic eon, yielding their supremacy in later times to the Chilo- , which are represented doubtfully in the Paleozoic seas by the enus Paleschara. In the Trenton the Cyclostomata are fairly well represented—the Ctenostomata scarcely at all—but this r because ctenostomatous bryozoa rarely admit of preservation sils. Of the Ctenostomata only six species have been describ Eopaleozoic; but about twenty other undescribed species are some of which are from Neopaleozoic formations. Among the stomata the Ceramoporidæ and Diastoporidæ predominate dur Trenton, the Monticuliporidæ and Trematoporidæ among the stomata, the Arthrostylidæ and Rhinidictyonidæ among the C stomata.

The succeeding period, the Cincinnati, is very similar to its cessor in its bryozoan fauna, the various suborders maintaining the same relative representation. About one hundred unde species are known, and it is probable that many species still aw covery. The predominant families are the Ceramoporidæ amo Cyclostomata, the Monticuliporidæ and Heterotrypidæ amo Trepostomata, and the Ptilodictyonidæ and Rhinidictyonidæ the Cryptostomata.

The Anticosti group forms the connecting link between the vician and Silurian eras. In this formation the Trepostomata found fairly numerous. A few species have been described b ings, but were so meagerly characterized that we are unable t them generically, and hence have omitted them from our tables Cryptostomata appear to predominate, though when the faun have been thoroughly studied the Trepostomata may be found still slightly in the lead.

From the Medina, which is practically limited to the State o York, no bryozoa have been made known. The Clinton conta few bryozoa, and these are generally not well preserved. The stomata have now dropped from first to second place, the Cryptos are very much in the lead, the Cyclostomata rare. The Ptilo nidæ now reach their maximum and are the predominant famil in number of species and in individuals.

With the Niagara a decided change has come. Large forms a paratively rare; even among the Trepostomata the tendency to tiveness is very noticeable. The Cryptostomata greatly predo the Cyclostomata and Trepostomata are about equally repre The Ceramoporidæ are giving place to the Fistuliporidæ, p their descendants. Among the Trepostomata the Batostomelli most enduring family of the bryozoa in Paleozoic time, predo Among the Cryptostomata the Fenestellidæ lead, and from th on are the chief family.

The Lower Helderberg is similar in its bryozoan fauna to th ara, but the Fenestellidæ have been increasing rapidly and no nearly one-third of the bryozoa. No Cyclostomata except those ing to the Fistuliporidæ and Ceramoporidæ have been recorded

Upper Helderberg fauna emphasizes the tendency begun in the ra and strengthened in the Lower Helderberg—namely, the ition of the Trepostomata and the augmentation of the Crypto- a. The Trepostomata are now of little importance; the Fenes- far outweigh all other families and constitute considerably over lf the fauna.

Hamilton fauna excels all others at present in the number of bed species and genera represented. Probably a large amount onymy still exists which time will eliminate. However, future eries will probably disclose a number of new species more than ent to offset the loss by reduction from synonyms. The Trepo- a are the least important element, and are about ready to disap- Naturally they present a jumble of features which makes them lt to classify along with those of Eopaleozoic age. The Fistuli- have become wonderfully numerous in species and genera. itostomellidæ are at their maximum; so also are the Fenestellidæ. alls of the Ohio has proved, probably, to be the most prolific locality for bryozoa in the world. The Cystodictyonidæ are their maximum. In fact, the Hamilton may be said to mark the ation of Paleozoic bryozoa.

he interval between the Hamilton and the Osage, the next for- in which the bryozoa form a large element of the fauna, several tions were laid down under conditions commonly unfavorable for oan life, though future collections may materially alter this con- . The earliest of the Mississippian series, the Kinderhook, has r shown but few bryozoa. The earlier of the Osage formations, rlington, has also thus far proved poor collecting ground, but okuk and Warsaw, following, have an abundant bryozoan fauna. rsaw, Ill., the Warsaw formation bears a close relationship to okuk fauna, but at other points the Warsaw seems more closely to the St. Louis, following it, than to the Keokuk, preceding. se formations the Cryptostomata are monopolists, but few Cyclo- a and Trepostomata occurring. So it continues throughout the sippian series. The Fenestellidæ continue to be the predominant . As is the case in other tribes of the animal kingdom, when a f structure culminates, the family evolves a great many variations, curious, and even grotesque, ere it reaches its extinction. The uis, an almost solid limestone formation, has not been favorable e preservation of bryozoa. The Ste. Genevieve, which differs he St. Louis in having less limestone and more shale, has a con- ble bryozoan fauna, with the Fenestellidæ still much in excess of her groups. In the Chester the Fenestella type produces two s genera in form of growth, the Lyropora and Archimedes, both ch must have been beautiful objects when living.

It might be expected that the Coal Measures, from the mode o formation, would not yield many bryozoa. Not many indiv comparatively have been found, yet 62 species assigned to 15 have been recorded. The Fenestellidæ are still the most num The Permian, perhaps because it has been but little investigat but few species. The close of the Paleozoic sees the extinction bryozoan fauna. The next fauna in America, the bryozoa fr Cretaceous marl of New Jersey, wears an entirely different facies Trepostomata and Cryptostomata are scarcely, if at all, repres the Cyclostomata are numerous, and the Chilostomata even mor

LIST OF LOCALITIES.

The following list gives the principal localities from which b have been recorded. The asterisk (*) has been placed before th important and typical localities.

ORDOVICIAN.

CHAZY.

Canada.—Mingan.
Vermont.—Granville.
New York.—*Chazy, Galway.

TRENTON.

STONES RIVER (BIRDSEYE) DIVISION.

Lake Huron.—St. Joseph Island.
New York.—*Watertown.
Illinois.—*Dixon and Calhoun County.
Wisconsin.—Mineral Point, Janesville, Beloit.
Minnesota.—*Minneapolis, *St. Paul, *Cannon Falls, Chatfield, Fountain, boro, Preston.
Kentucky.—*High Bridge, Frankfort.
Tennessee.—Knoxville, *Lebanon, *Murfreesboro, Shelbyville, Lavergne, bia, Franklin.

BLACK RIVER DIVISION.

New York.—Watertown, Chazy.
Wisconsin.—Beloit.
Minnesota.—*Minneapolis, *St. Paul; Cannon Falls, Fountain, Preston, La and other localities in Goodhue and Fillmore counties.
Iowa.—Decorah.
Illinois.—Rockton.

TRENTON DIVISION.

Quebec.—Montreal, Joliette, Quebec.
Ontario.—*Ottawa, *Peterborough, Belleville.
Vermont.—Chimney Point, Bridport.
New York.—*Trenton Falls, Middleville, Jacksonburg, *Watertown, L Turin, Little Falls, Chazy.

toba.—St. Andrews, East Selkirk; Big, Deer, and Little Black islands, in Lake
peg.
esota.—*St. Paul, *Cannon Falls, Kenyon, Berne, Hader, Mantorville, and
es in Ramsay, Goodhue, Olmstead, and Fillmore counties.
igan.—Escanaba River.
nsin.—Neenah.
is.—Rockton, Calhoun County, Alexander County (Thebes).
ucky.—*Covington, *Burgin, *Frankfort, Harrodsburg, Paris, Georgetown,
ton, Nicholasville, Danville, Colby, Mercer County, Garrard County.
essee.—*Nashville, Franklin, Mt. Pleasant, and many other localities in the
basin.
da.—Silver Canyon, Pahranagat Range.

CINCINNATI.

UTICA DIVISION.

da.—Ottawa.
York.—Utica, Rome.
—*Cincinnati, Milford, Loveland, Batavia.
na.—Numerous localities in the southeastern corner of the State.
ucky.—*Covington, *Newport, Maysville, Augusta, Frankfort, Harrodsburg.
—Graf, Lantnerville.
esota.—Fillmore County.

LORRAINE DIVISION.

io.—Toronto, Weston, River Credit.
York.—Turin, Lorraine, Pulaski.
—*Cincinnati, *Hamilton, *Lebanon, Mason, Morrow, Loveland, and other
s in Hamilton, Clermont, Warren, and Butler counties.
na.—Numerous localities in the southeastern part of the State.
ucky.—*Covington, *Newport, Maysville, McKinneys, and many localities in
Lincoln, and other counties in the central part of the State.
essee.—*Nashville, *Columbia, Mt. Pleasant, Swan Creek, and many localities
dle Tennessee.

RICHMOND DIVISION.

osti Island (*Gulf of St. Lawrence*).
io.—Toronto, Oakville, ? Weston.
—*Blanchester, Westboro, *Oregonia, *Waynesville, Middletown, *Oxford,
ille, Hanover, Camden, Jacksonburg, Lynchburg, and other localities in
nd, Brown, Clinton, Warren, and Butler counties.
na.—*Richmond, *Versailles, Osgood, Weisburg, and other localities in the
stern part of the State.
ucky.—*Lebanon, Raywick, Mount Washington, Richmond, and localities in
Washington, and Nelson counties.
is.—*Wilmington, Savannah, Sterling, South Elgin.
nsin.—Delafield, Iron Ridge.
esota.—Spring Valley.
oba.—Stony Mountain.

SILURIAN (UPPER).

ANTICOSTI.

osti Island (*Gulf of St. Lawrence*).—The lower part of the Anticosti occupies
erval between the Richmond and the Clinton, probably contemporaneous
e Medina. The upper part is the equivalent of the Clinton.

CLINTON.

Ontario.—Flamborough Head, Dundas, *Hamilton.

New York.—Wayne County.

Tennessee.—Cumberland Gap.

Alabama.—Collinsville.

Ohio.—*Dayton, *Eaton, Centreville, *Fair Haven, near New Carlisle, Todds Fork, and other localities in Clinton and Preble counties.

Indiana.—Hanover.

NIAGARA.

Ontario.—Hamilton, Thorold, Flamborough Head.

New York.—*Lockport, Rochester, Reynales Basin, Gasport.

Ohio.—Cedarville.

Indiana.—*Waldron, *Osgood.

Illinois.—Sterling, Savannah, South Elgin, Chicago.

Tennessee.—Localities in Perry, Hardin, Hickman, and Wayne counties.

LOWER HELDERBERG.

New York.—* Clarksville, * Schoharie, Catskill.

Tennessee.—Localities in Perry and Hickman counties.

DEVONIAN.

ORISKANY (?).

None recorded except from the Gaspé Limestone at Indian Cove, Gaspé B Grand Creve, Canada.

UPPER HELDERBERG (CORNIFEROUS).

New York.—Onondaga Valley, Cherry Valley, near Caledonia, Stafford, Sc Thompsons Lake (Albany County), Waterville, Falkirk, near Buffalo, * Le

Ontario.—Port Colborne, Port Jarvis, * Walpole, Wainfleet.

Ohio.—Sandusky, Columbus, Sylvania, Marblehead, Whitehouse (Lucas C

HAMILTON.

New York.—Cazenovia, near Leonardsville, New Berlin, Delphi, Nortons (Cayuga Lake), Owasco Lake, Lodi Landing (Seneca Lake), Bellona, Hopeto County), * Canandaigua, Monteiths Point (Lake Canandaigua), Fall Bro Lake Canandaigua, West Bloomfield, near Muttonville (Ontario County), * * York, near Geneseo, Darien Center, Pavilion, * West Hamburg, Alden, * E mile Creek, and other localities in Cayuga, Seneca, Ontario, Livingston, a counties.

Ontario.—* Widder (now Thedford), Arkona, Bartletts Mills, West Willia

Canada.—Lake Winnepegosis, Hay River, Athabasca River, near Dawson B Deer River.

Michigan.—* Alpena, Thunder Bay Island, Partridge Point (near A * Petoskey.

Indiana.—Utica, * Falls of the Ohio.

Illinois.—Rock Island, Andalusia.

Iowa.—* Buffalo, Davenport, Muscatine, Independence, Hackberry, Rockfo City.

Wisconsin.—Milwaukee.

Missouri.—Calloway County.

MISSISSIPPIAN.

KINDERHOOK.

—Marshalltown.

BURLINGTON.

—Burlington.

is.—Quincy, Montezuma, Sagetown (Henderson County), Calhoun County.

WAVERLY (=KINDERHOOK TO KEOKUK).

—Lodi, Richfield, Sciotoville, Newark, Burbank, Moots Run, Cuyahoga .

gan.—Hillsdale.

KEOKUK.

is.—* Nauvoo, Warsaw, near Whitehall, Jersey County, near Plymouth, County, Appanoosa (near Quincy).

—* Keokuk, * Bentonsport.

uri.—Lagrange, St. Francisville, Clark County.

cky.—* Kings Mountain, near Somerset, Button Mole Knob (near Louisville).

WARSAW.

na.—Spergen Hill.

is.—*Warsaw, Columbia and other localities in Monroe County, near New ence.

uri.—Barrett's (St. Louis County), Curryville.

ST. LOUIS.

is.—Alton, Waterloo, Prairie du Rocher.

uri.—St. Louis, Ste. Genevieve.

cky.—Eddyville, Elizabethtown, Somerset, Colesburg, and other localities in ll, Lyon, and Crittenden counties.

ssee.—Clarksville.

Virginia.—Between Fort Springs and Ronceverte.

STE. GENEVIEVE.

—Pella.

uri.—Ste. Genevieve.

is.—Rosiclare.

cky.—Princeton, Cerulean Springs, and other localities in Trigg and Caldwell s.

CHESTER.

—Newtonville.

is.—*Chester, Kaskaskia (now Fort Gage), *Red Bud, Ruma, Baldwin, ood, Anna.

cky.—*Sloans Valley (or Tateville), Grayson Springs, Litchfield, Stephens-mithland, and localities in Crittenden, Caldwell, Livingston, Meade, Pulaski, ckson counties.

ama.—Huntsville.

CARBONIFEROUS.

COAL MEASURES.

Ohio.—Newark, Flint Ridge, Bald Hill.

Illinois.—Lasalle, *Seville, Knox County, Peoria, Danville, Springfield and localities in Sangamon County, Caseyville, Sparta, near Centralia, and local Macoupin, Jasper, and Fayette counties.

Iowa.—Red Oak.

Missouri.—Kansas City.

Nebraska.—Nebraska City, Wyoming.

Kansas.—Manhattan, Fort Riley, Greenwood County.

Indian Territory.—Poteau Mountain.

PERMIAN.

Kansas.—Cottonwood Valley and other unrecorded localities.

New Mexico.—Guadalupe Mountains, Jornada de Muerto.

CARBONIFEROUS (division not specified).

Nova Scotia.—Windsor, Stewiacke.

Montana.—Mystic Lake.

New Mexico.—Organ Mountains.

Arizona.—White Mountains, confluence White Mountain and Black rivers.

Texas.—Fort Belknap.

CRETACEOUS.

New Jersey.—Timber Creek, Mullica Hill, Brownsville, Vincentown.

Mississippi.—Seven miles below Yazoo.

Arkansas.—Pulaski County (10 miles south of Little Rock).

EOCENE.

Maryland.—Upper Marlboro.

Virginia.—"Rock's bridge" (may not be in Virginia) and other localities.

North Carolina.—Wilmington.

South Carolina.—Eutaw, Wantoot, Charleston.

Alabama.—Claiborne.

Mississippi.—Vicksburg.

MIOCENE.

Maryland.—St. Mary's River, Jones' Wharf.

Virginia.—Williamsburg, Petersburg, Evergreen, Yorktown, Carter's Land

PLIOCENE.

South Carolina.—Darlington District, Giles Bluff on Peedee River, Smit Goose Creek. (Note.—Holmes considered these deposits of Pliocene age, Ga Horn think them Miocene.)

POST-PLIOCENE.

South Carolina.—Charleston.

California.—Santa Barbara. (See Gabb and Horn, Journal Academy Sciences Philadelphia, series 2, V, p. 179.)

SUCCESSION OF BRYOZOAN FAUNAS.

ubjoined table is designed to show the succession of bryozoan The formations in the same column do not always have the xonomic rank, as now generally regarded. It is to be noted ge in such matters is not uniform and is probably in a transitage.

Table showing the occurrence of bryozoa by formations.

	Pliocene		Not many known in North America; very abundant in Europe.
	Miocene		
			A moderate number known.
			None known.
	Permian		A limited number.
ous	Upper Coal Measures		A fair number.
	Lower Coal Measures		
	Conglomerate		None known.
	Chester	Upper	Abundant.
		Middle (Lyropora beds)	
		Lower (Kaskaskia limestone).	
		Big Clifty (=Aux Vases) sandstone.	None known.
	St. Louis	Ste. Genevieve limestone	A fair number.
an		St. Louis limestone	Rather few.
		Warsaw beds	Abundant.
	Osage	Keokuk	
		Upper Burlington	Few.
		Lower Burlington	
	Kinderhook	Choteau limestone	Very few known.
		Hannibal shale	
		Louisiana limestone	
	Chemung		Very few known.
	Hamilton		Abundant.
	Upper Helderberg		
	Oriskany		Very few known.
	Lower Helderberg		Abundant.
	Onondaga		None known.
pper)	Niagara	Lockport[1]	Abundant.
		Rochester[1]	
		Clinton and Anticosti	A moderate number.
		Medina	None known.
	Cincinnati	Richmond	Very abundant.
		Lorraine	
		Utica	
	Trenton	Trenton	
		Black River	
		Stones River	
	Chazy		A few known.
	Calciferous		None known.
			Do.

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adopted by the United States Geological Survey for formations formerly called Niagara and Niagara shale, respectively. In this work the term Niagara refers to these two forma- together and excluding Clinton and Medina.

LISTS OF SPECIES.

CHAZY.

Phylloporina aspera (Hall).
gracilis (Hall).
incepta (Hall).
Rhinidictya fenestrata (Hall).
Stenopora ?? adherens Billings.
?? patula Billings.
Stictopora ? glomerata Hall.

TRENTON.

	Stones River.	Black River.
Amplexopora ? discoidea (Nicholson)		
Anolotichia impolita (Ulrich)	×	
Arthroclema armatum Ulrich		
billingsi Ulrich		
cornutum Ulrich		×
pulchellum Billings		
striatum Ulrich		×
Arthropora bifurcata Ulrich		×
reversa Ulrich		
simplex Ulrich	×	×
Arthrostylus conjunctus Ulrich		×
obliquus Ulrich	×	
tenuis (James)		
Aspidopora calycula (James)		
elegantula Ulrich		
parasitica Ulrich	×	×
Atactoporella ? crassa Ulrich		
insueta Ulrich		×
ramosa Ulrich		×
typicalis-præcipta Ulrich		×
Batostoma canadense (Foord)		×
? decipiens Ulrich	×	×
fertile Ulrich	×	
fertile-circulare Ulrich	×	
humile Ulrich		
magnoporum Ulrich		×
minnesotense Ulrich		×
montuosum Ulrich		×
superbum (Foord)		
varium Ulrich		×
winchelli (Ulrich)		×
winchelli-nodosum Ulrich		×
winchelli-spinulosum Ulrich		×
Berenicea minnesotensis Ulrich	×	×

Lists of species—Continued.

TRENTON—Continued.

	Stones River.	Black River.	Trenton.
a alcicornis Ulrich		×	
herricki Ulrich		×	
pa laxata (Ulrich)	×	×	×
ampla Ulrich		×	×
angularis Ulrich	×		
? crenulata Ulrich		×	×
dumalis Ulrich	×	×	
goodhuensis Ulrich			×
incontroversa Ulrich	×		
multitabulata (Ulrich)		×	×
pulchella Ulrich		×	
pulchella-persimilis Ulrich		×	
undulata Ulrich		×	
ylla frondosa Ulrich		×	
rella inclusa Ulrich	×	×	×
interporosa Ulrich			×
? rugosus Hall			×
a trentonense (Ulrich)			×
ia fischeri Ulrich			×
varia Ulrich			×
perampla Ulrich	×		
simulans Ulrich			×
spatiosa Ulrich			×
subæquata Ulrich		×	
venusta (Ulrich)			×
prænuntia Ulrich		×	
prænuntia-echinata Ulrich		×	
prænuntia-multipora Ulrich		×	
prænuntia-nævigera Ulrich		×	
prænuntia-simplex Ulrich	×	×	
trentonensis (Ulrich)			×
ina flabellata Ulrich			×
a trentonense Ulrich			×
a limitaris Ulrich			×
neglecta Ulrich			×
westoni Ulrich			×
pa dichotoma Ulrich			×
a briareus (Nicholson)			×
exigua Ulrich			×

Lists of species—Continued.

TRENTON—Continued.

	Stones River.	Blac Rive
Eridotrypa mutabilis Ulrich		
mutabilis-minor Ulrich		
trentonensis (Nicholson)		
Escharopora angularis Ulrich	×	
briareus (Ulrich)	×	
confluens Ulrich		×
libana (Safford)	×	
? limitaris Ulrich	×	×
ramosa (Ulrich)	×	
recta Hall		
recta-nodosa Hall		
subrecta (Ulrich)		×
Eurydictya calhounensis Ulrich		
multipora (Hall)		×
Helopora alternata Ulrich		×
divaricata Ulrich	×	
mucronata Ulrich		
quadrata Ulrich		
spiniformis (Ulrich)	×	
Hemiphragma irrasum (Ulrich)	×	×
ottawense (Foord)		×
tenuimurale Ulrich		
Homotrypa ? arbuscula Ulrich	×	
callosa Ulrich		
exilis Ulrich	×	
? intercalaris Ulrich		×
minnesotensis Ulrich	×	×
minnesotensis-montifera Ulrich		×
separata Ulrich	×	
? similis Foord		
subramosa Ulrich		×
subramosa-insignis Ulrich		
tuberculata Ulrich		×
Homotrypella granulifera (Ulrich)		
instabilis Ulrich		×
multiporata Ulrich		×
mundula Ulrich		
? ovata Ulrich		×
? subgracilis Ulrich		×

Lists of species—Continued.

TRENTON—Continued.

	Stones River.	Black River.	Trenton.
Leptotrypa ? acervulosa Ulrich			×
? claviformis Ulrich		×	
? hexagonalis Ulrich	×		
informis Ulrich	×		
Mesotrypa discoidea Ulrich			×
infida (Ulrich)		×	
quebecensis (Ami)			×
regularis (Foord)			×
? rotunda Ulrich			×
selkirkensis Whiteaves			×
? spinosa Ulrich		×	
whiteavesi (Nicholson)			×
Mitoclema cinctosum Ulrich	×		
? mundulum Ulrich			×
Monotrypa cumulata Ulrich			×
intabulata Ulrich			×
magna Ulrich	×		
rectimuralis Ulrich			×
undulata (Nicholson)			×
Monticulipora arborea Ulrich			×
billingsi Foord			×
? cannonensis Ulrich		×	×
incompta Ulrich		×	
westoni Foord			×
wetherbyi Ulrich	×		
Nematopora alternata Ulrich			×
conferta Ulrich			×
delicatula Ulrich			×
fragilis Ulrich			×
granosa Ulrich			×
ovalis Ulrich			×
retrorsa Ulrich			×
Nicholsonella laminata Ulrich		×	
ponderosa Ulrich	×		
pulchra Ulrich	×		
Pachydictya acuta (Hall)			×
elegans Ulrich			×
everetti Ulrich	×		
fimbriata Ulrich		×	

Lists of species—Continued.

TRENTON—Continued.

	Stones River.	Black River.	Trenton.
Pachydictya foliata Ulrich	×		
magnipora Ulrich			×
occidentalis Ulrich		×	
pumila Ulrich			×
pumila-sublata Ulrich			×
robusta Ulrich	×		
triserialis Ulrich			×
Phacelopora pertenuis Ulrich			×
Phænopora incipiens Ulrich			×
Phyllodictya frondosa Ulrich	×		
varia Ulrich		×	
Phylloporina corticosa (Ulrich)			×
dawsoni Ulrich			×
fenestrata (Hall)			×
granistriata Ulrich			×
halli Ulrich		×	
reticulata (Hall)		×	×
sublaxa Ulrich	×		
trentonensis (Nicholson)			×
Prasopora affinis Foord			×
conoidea Ulrich		×	
contigua Ulrich		×	
grandis (Ulrich)	×		×
insularis Ulrich			×
insularis-filmorensis Ulrich			×
lenticularis Ulrich		×	
nodosa Ulrich			×
oculata Foord			×
selwyni (Nicholson)			×
simulatrix Ulrich		×	×
simulatrix-orientalis Ulrich			×
Proboscina tumulosa Ulrich		×	
Protocrisina exigua Ulrich			×
Rhinidictya basalis (Ulrich)	×		
exigua Ulrich	×	×	
fidelis Ulrich	×		
grandis Ulrich	×		
minima Ulrich			×
minima-modesta Ulrich			×

Lists of species—Continued.

TRENTON—Continued.

	Stones River.	Black River.	Trenton.
tya mutabilis (Ulrich)	×	×	×
mutabilis-major (Ulrich)		×	
mutabilis-senilis Ulrich		×	
nashvillensis (Miller)	×		
neglecta Ulrich			×
neglecta-canadensis Ulrich			×
nicholsoni Ulrich	×		
paupera Ulrich		×	
pediculata Ulrich	×		
trentonensis (Ulrich)	×		
ora radiata Ulrich	×		
a ? areolata Foord			×
labeculosa Ulrich		×	
lineata-incepta Ulrich		×	
antheloidea Hall			×
a elegantula Hall			×
? labyrinthica Hall	×		
? ramosa Hall	×		
ella angularis Ulrich	×		
angularis-intermedia Ulrich	×		
cribrosa Ulrich	×	×	
dumosa Ulrich		×	
exigua Ulrich			×
flabellata (Hall)			×
frondifera Ulrich	×		
rigida Ulrich		×	
ora arachnoidea (Hall)			×
canadensis Whiteaves			×
delicatula (James)	×	×	×
inflata (Hall)		×	×
trypa ovata Ulrich	×	×	
ora calloporoides Ulrich			×
debilis Ulrich			×
? primigenia Ulrich		×	
? primigenia-ornata Ulrich		×	
? primigenia-spinosa Ulrich		×	
ictya conciliatrix Ulrich		×	
epens Ulrich		×	

Lists of species—Continued.

CINCINNATI.

	Utica.	Lorraine.	Rich-mond.
Amplexopora cingulata Ulrich		×	
? discoidea (Nicholson)		×	
filiosa (D'Orbigny)		×	
petasiformis (Nicholson)	×		
petasiformis-welchi (James)	×		
pustulosa Ulrich			×
robusta Ulrich		×	
septosa (Ulrich)	×	×	
Anolotichia ponderosa Ulrich			×
Arthroclema angulare Ulrich			×
Arthropora shafferi (Meek)		×	
shafferi-cleavelandi (James)	×		
Arthrostylus curtus Ulrich	×		
tenuis (James)	×		
Aspidopora areolata Ulrich	×		
eccentrica (James)	×		
newberryi (Nicholson)	×		
Atactopora hirsuta Ulrich	×	×	
maculata Ulrich		×	
Atactoporella multigranosa (Ulrich)		×	
mundula (Ulrich)		×	
newportensis Ulrich	×		
ortoni (Nicholson)		×	
schucherti Ulrich			×
tenella (Ulrich)		×	
typicalis Ulrich	×		
Batostoma implicatum (Nicholson)	×		
jamesi (Nicholson)	×		
manitobense Ulrich			×
? rugosum (Whitfield)			×
varians (James)			×
Berenicea primitiva Ulrich		×	×
vesiculosa Ulrich	×		
Bythopora arctipora (Nicholson)	×		
delicatula (Nicholson)			×
dendrina (James)		×	
gracilis (Nicholson)		×	
meeki (James)			×
parvula (James)	×		
striata Ulrich			×

Lists of species—Continued.

CINCINNATI—Continued.

	Utica.	Lorraine.	Richmond.
ypa epidermata (Ulrich)			×
a andrewsi (Nicholson)		×	
dalei (Edwards and Haime)		×	
nodulosa (Nicholson)	×		
onealli (James)	×		
onealli-communis (James)	×		
onealli-sigillarioides (Nicholson)	×		
ramosa (D'Orbigny)		×	
rugosa (Edwards and Haime)		×	
subnodosa Ulrich			×
subplana Ulrich		×	
ella circularis (James)			×
? lens (Whitfield)			×
? nodulosa Ulrich			×
orella distincta Ulrich	×	×	
granulosa Ulrich			×
granulosa-milfordensis (James)	×		
irregularis (Whitfield)			×
ohioensis (Nicholson)	×	×	×
stellata Ulrich			×
whitei (James)		×	×
rella nicholsoni (James)		×	
na alternatum (James)	×		
concentricum (James)	×		
oweni (James)		×	
aria constellata (Van Cleve) Dana		×	
constellata-plana Ulrich		×	
constellata-prominens Ulrich	×	×	
limitaris (Ulrich)			×
parva Ulrich			×
polystomella Nicholson			×
punctata (Whitfield)			×
ra hemispherica Ulrich			×
impressa Ulrich		×	
simulans Ulrich		×	×
solida Ulrich	×		
venusta (Ulrich)	×		
la obscura Ulrich	×		
ulrichi (Nicholson)	×		
ulrichi-robusta Foord	×		

Lists of species—Continued.

CINCINNATI—Continued.

	Utica.	Lorraine.	Richmond.
Dekayia appressa Ulrich		×	
aspera Edwards and Haime		×	
maculata James	×		
multispinosa Ulrich		×	
pelliculata Ulrich		×	
Dicranopora emacerata (Nicholson)		×	×
fragilis (Billings)			×
internodia (Miller and Dyer)		×	
nitidula (Billings)			×
Diplotrypa ? dubia Ulrich			×
Discotrypa elegans (Ulrich)		×	
Eridotrypa simulatrix (Ulrich)			×
Escharopora acuminata (James)	×		
falciformis (Nicholson)		×	
hilli (James)		×	
maculata (Ulrich)		×	
pavonia (D'Orbigny)		×	
Eurydictya montifera Ulrich			×
sterlingensis Ulrich			×
Fenestella granulosa Whitfield			×
Goniotrypa bilateralis Ulrich			×
Graptodictya perelegans (Ulrich)			×
Helopora elegans Ulrich			×
harrisi James			×
imbricata Ulrich			×
Hemiphragma imperfectum (Ulrich)			×
whitfieldi (James)	×		
Heterotrypa affinis (Ulrich)			×
frondosa (D'Orbigny)		×	
inflecta Ulrich		×	
paupera (Ulrich)		×	
singularis Ulrich			×
solitaria Ulrich		×	
subpulchella (Nicholson)		×	
subramosa (Ulrich)			×
subramosa-prolifica Ulrich			×
Homotrypa curvata Ulrich		×	
dawsoni (Nicholson)		×	×
flabellaris Ulrich		×	×
gelasinosa Ulrich			×
obliqua Ulrich		×	

Lists of species—Continued.

CINCINNATI—Continued.

	Utica.	Lorraine.	Richmond.
ella contexta Ulrich			×
rustica Ulrich			×
a calceola (Miller and Dyer)		×	
clavacoidea (James)		×	
? clavis Ulrich	×		
? cortex Ulrich	×		
? dychei (James)		×	
? irregularis (Ulrich)		×	
minima Ulrich		×	
ornata Ulrich		×	
? semipilaris Ulrich		×	
stidhami Ulrich			×
? wilmingtonense Ulrich			×
la annulifera (Whitfield)			×
fusiformis (Whitfield)			×
nitida (Ulrich)			×
solidissima (Whitfield)			×
subfusiformis (James)			×
patella (Ulrich)			×
a nodosa Ulrich			×
turbinata (James)	×		
undulata-hemispherica (J. F. James)			×
ella æqualis Ulrich	×		
crassimuralis Ulrich			×
quadrata (Rominger)			×
subquadrata Ulrich			×
pora cincinnatiensis (James)		×	
?? cleavelandi James			×
lævis Ulrich			×
lævis-consimilis Ulrich			×
lamellosa Ulrich			×
mammulata D'Orbigny		×	
molesta Nicholson		×	
parasitica Ulrich			×
parasitica-plana Ulrich			×
?? winchelli James			×
?? wortheni James			×
ella cumulata Ulrich			×
vaupeli (Ulrich)		×	

Lists of species—Continued.

CINCINNATI—Continued.

	Utica.	'Lor
Pachydictya fenestelliformis (Nicholson)		
fenestelliformis-corticula Ulrich		
? firma Ulrich		
gigantea Ulrich		
hexagonalis Ulrich		
? splendens Ulrich		
Paleschara beani (James)	×	
Peronopora compressa (Ulrich)		
decipiens (Rominger)		
Petigopora asperula Ulrich		
gregaria Ulrich		
petechialis (Nicholson)		
scabiosa Ulrich		
Phænopora wilmingtonensis Ulrich		
Phylloporina clathrata (Miller and Dyer)		
variolata (Ulrich)	×	
Prasopora ? hospitalis (Nicholson)		
Proboscina auloporoides (Nicholson)		
confusa (Nicholson)	×	
frondosa (Nicholson)		
Protocrisina exigua Ulrich		
Ptilodictya canadensis Billings		
flagellum Nicholson		
magnifica Miller		
nodosa James		
plumaria James		
whiteavesi Ulrich		
Ptilotrypa obliquata Ulrich		
Rhinidictya lata (Ulrich)		
parallela James	×	
Rhopalonaria venosa Ulrich		
Sceptropora facula Ulrich		
Spatiopora aspera Ulrich		
corticans (Nicholson)		
iowensis Ulrich	×	
lineata Ulrich		
maculosa Ulrich		
montifera Ulrich		
tuberculata (Edwards and Haime)		

Lists of species—Continued.

CINCINNATI—Continued.

	Utica.	Lorraine.	Richmond.
la flexuosa (James)	×		
ra arachnoidea (Hall)	×	×	×
delicatula (James)	×	×	×
delicatula-tenuissima Ulrich	×		
inflata (Hall)		×	×
turgida Ulrich			×
ra ?? granulata Whitfield			×
lialis Ulrich		×	

SILURIAN.

	Anticosti.	Clinton.	Niagara.	Lower Held.
a parmula (Foerste)		×		
parmula-fenestelliformis Foerste		×		
lla ? aspera (Hall)			×	
granulifera (Hall)			×	
elegans (Hall)			×	
membranacea (Hall)			×	
spinulosa (Hall)			×	
?? cervicornis Hall			×	
?? diversa Hall			×	
elegantula Hall			×	
magnopora Foerste		×		
?? nummiformis Hall			×	
?? oppleta Hall and Simpson				×
perelegans Hall				×
heteropora (Hall)				×
macropora (Hall)				×
macropora-signata (Hall)				×
oculifera (Hall)				×
paucipora Hall and Simpson				×
striata (Hall and Simpson)				×
unispina (Hall)				×
ra ? confluens Hall			×	
? expansa James		×		
? explanata Hall			×	
imbricata Hall			×	
? labeculoidea Hall				×

Lists of species—Continued.

SILURIAN—Continued.

	Anticosti.	Clinton.	Niagara.	Lower Held.
Ceramopora ? maculata Hall				×
? notha Hall			×	
orbiculata Ringueberg			×	
? parvicella Hall				×
? raripora Hall			×	
Chætetes ?? expansus Ringueberg			×	
Chilotrypa ? coalescens (Hall)			×	
dispersa (Hall)				×
ostiolata (Hall)			×	
varia (Hall)			×	
variolata (Hall)			×	
Clathropora ? alcicornis Hall			×	
frondosa Hall		×	×	
frondosa-clintonensis Hall and Whitfield		×		
intermedia Nicholson and Hinde			×	
Cœlocaulis ? mediopora (Hall)				×
venusta (Hall)				×
Diamesopora dichotoma Hall			×	
infrequens (Hall)			×	
osculum (Hall)			×	
subimbricata (Hall)			×	
? tubulosa (Hall)		×		
Dicranopora fragilis (Billings)	×			
granulosa (Hall and Simpson)				×
Diploclema sparsum (Hall)			×	
Drymotrypa cisseis (Hall)				×
diffusa (Hall)			×	
niagarensis (Hall)			×	
Eridotrypa corticosa (Hall)				×
echinata (Hall)			×	
Fenestella acuticosta Roemer			×	
adornata Hall and Simpson				×
adraste Hall				×
æsyle Hall				×
althæa Hall				×
bellistriata Hall			×	
cleia Hall				×
crebripora Hall				×
? cribrosa Hall			×	

Lists of species—Continued.

SILURIAN—Continued.

	Anticosti.	Clinton.	Niagara.	Lower Held.
elegans Hall			×	
? frequens Hall				×
hestia Hall				×
? idalia Hall				×
juncea Hall				×
noe Hall and Simpson				×
parvulipora Hall			×	
pertenuis Hall			×	
philia Hall				×
prolixa Hall			×	
spio Hall and Simpson				×
sylvia Hall				×
tenuis Hall		×		
a ? crassa (Hall)				×
distans (Hall)				×
halli Rominger			×	
hemispherica (Roemer)			×	
maculosa (Hall)				×
neglecta Rominger			×	
neglecta-maculata Hall			×	
serialis (Hall and Simpson)				×
torta (Hall)				×
? triloba Hall and Simpson				×
a latispiralis Claypole			×	
armata Billings	×			
ellula Billings	×			
? circe Billings	×			
? concava Billings	×			
agilis Hall		×	×	
? irregularis Billings	×			
odosa Billings	×			
? varipora Billings	×			
a biserialis (Hall)				×
biserialis-exilis (Hall and Simpson)				×
ulrichi Foerste		×		
a ? confluens Foerste		×		
? solida (Hall)			×	
chis nereis Hall				×
parasitica Ulrich			×	
a ? sphærion (Hall)			×	

Lists of species—Continued.

SILURIAN—Continued.

	Anticosti.	Clinton.	Niaga
Lichenalia concentrica Hall			×
Lioclema asperum (Hall)			×
cellulosum (Hall)			
? exsul (Hall)			×
(? Nicholsonella) floridum (Hall)			×
(? Nicholsonella) laminatum (Hall)			×
parasiticum (Hall)			
ponderosum (Hall)			
Lioclemella ohioensis (Foerste)		×	
Loculipora ambigua (Hall)			×
loculata (Hall)			
Meekopora foliacea (Hall)			×
Mesotrypa milleri (Ulrich)			×
Monotrypa colliculata (Hall)			
? helderbergiæ (Hall)			
monticulata (Hall)			
? proxima (Hall)			
sphærica (Hall)			
?? spinulosa (Hall and Simpson)			
tabulata (Hall)			
Monotrypella ? abrupta (Hall)			
? arbuscula (Hall)			
? consimilis (Hall)			×
? densa (Hall)			
Nematopora formosa (Billings)	×		
lineata (Billings)	×		
? lineopora (Billings)	×		
macropora (Hall)			×
minuta (Hall)			×
raripora (Hall)		×	×
striatopora (Billings)	×		
strigosa (Billings)	×		
Orthopora canaliculata (Hall)			
granilinea (Hall and Simpson)			
nodosa (Hall and Simpson)			
ovatipora (Hall)			
parallela (Hall)			
regularis (Hall)			
rhombifera (Hall)			

Lists of species—Continued.

SILURIAN—Continued.

	Anticosti.	Clinton.	Niagara.	Lower Held.
Pachydictya alcyone (Billings)	×			
bifurcata (Hall)		×		
bifurcata-instabilis Foerste		×		
crassa (Hall)	×	×	×	
emaciata Foerste		×		
? famelica Foerste		×		
obesa Foerste		×		
turgida Foerste		×		
Paleschara ?? bilateralis Hall				×
concentrica Hall and Simpson				×
? dissimilis (Hall)				×
? incrassata Hall			×	
incrustans Hall				×
? maculata Hall			×	
? offula Hall			×	
radiata Hall				×
? tenuis Hall and Simpson				×
Phænopora constellata Hall		×		
ensiformis Hall		×		
excellens (Billings)	×			
expansa Hall and Whitfield		×		
explanata Hall		×		
fimbriata (James)		×		
lirata (Hall)				×
magna (Hall and Whitfield)		×		
multifida (Hall)		×		
punctata (Nicholson and Hinde)		×		
superba (Billings)	×			
tenuis (Hall)				×
Phylloporina angulata (Hall)		×		
asperato-striata (Hall)			×	
Polypora albionensis Spencer			×	
arta (Hall)				×
compacta (Hall)				×
compressa (Hall)				×
conferta Hall			×	
eudora (Hall)				×
idothea (Hall)				×
incepta Hall			×	

Lists of species—Continued.

SILURIAN—Continued.

	Anticosti.	Clinton.	Niagara.	Lower Held.
Polypora lilæa Hall				×
obliqua (Hall)				×
paxillata (Hall)				×
punctostriata (Hall)			×	
? stricta (Hall and Simpson)				×
tantula (Hall)			×	
varia (Hall)				×
Ptilodictya angusta (Hall)			×	
expansa Hall		×		
expansa-emarcescens Foerste		×		
gladiola Billings	×			
nebulosa (Hall)				×
obliqua Ringueberg		×		
sulcata Billings	×			
? tenera (Billings)	×			
whitfieldi Foerste		×		
Ptiloporella nervata (Nicholson)			×	
Rhinopora ? tuberculosa Hall			×	
? tubulosa Hall		×		
verrucosa Hall		×		
Sceptropora fustiformis Ulrich		×		
Semicoscinium acmeum (Hall)			×	
? cleis (Hall)				×
coronis (Hall)				×
tenuiceps (Hall)			×	
thyene (Hall)				×
Stictopora ?? granatula Hall				×
?? obsoleta Hall and Simpson				×
?? papillosa Hall				×
Stictotrypa orbipora (Hall)			×	
punctipora (Hall)			×	
similis (Hall)			×	
Stomatopora parva Ringueberg			×	
recta Ringueberg			×	
Thamniscus dichotomus (Hall)			×	
fruticellus Hall				×
nysa Hall				×
variolatus Hall				×
Trematopora halli Ulrich			×	
?? punctata Hall			×	

Lists of species—Continued.

SILURIAN—Continued.

	Anticosti.	Clinton.	Niagara.	Lower Held.
ora ? singularis Hall			×	
? spiculata Miller			×	
?? superba Billings		×	×	
tuberculosa Hall			×	
whitfieldi Ulrich			×	
ictya eatonensis Ulrich		×		
nervia (Hall)				×
nervia-constricta (Hall)				×
præcursor (Hall)				×
quadrula (Hall)				×
adiciformis-conferta Ulrich			×	

DEVONIAN.

	Oriskany.	Upper Held.	Hamilton.
lema alternatum (Hall)		×	
divergens Hall and Simpson		×	
ovatum Hall and Simpson		×	
sulcatum Hall and Simpson			×
triseriale (Hall)		×	
a prolifera Hall			×
von fusiforme Nicholson and Etheridge, Jun			×
stellatum Nicholson and Etheridge, Jun			×
ra curvata Hall and Simpson			×
granistriata (Hall)			×
ora socialis Nicholson			×
a bistriata (Hall)			×
dentata Ulrich			×
lunata (Rominger)		×	
pyriformis (Hall)			×
a ? geniculata (Hall)		×	
internodata (Hall)			×
multiseriata (Hall)		×	
a scidacea Hall and Simpson			×
ora ?? imbricella Hall			×
?? hamiltonensis Winchell			×
?? microscopicus Winchell			×

Lists of species—Continued.

DEVONIAN—Continued.

	Oriskany.	Upper Held.
Chætetes ?? ponderosus Rominger		
?? tenuis Hall		×
Chilotrypa camerata (Hall)		×
Clathropora intertexta Nicholson		×
Clonopora incurva Hall		×
fasciculata Hall and Simpson		×
semireducta Hall		
Cœlocaulis ?? aculeolata Hall		×
?? hyale Hall		×
? irregularis (Hall)		×
Coscinella cosciniformis (Nicholson)		
elegantula Hall and Simpson		
Coscinium cribriforme Prout		
striatum Hall and Simpson		
striaturum (Hall)		×
Crisinella scrobiculata (Hall)		×
Cyclotrypa collina (Ulrich)		
communis (Ulrich)		
Cystodictya angularis (Hall and Simpson)		
bifurcata (Hall and Simpson)		
crescens (Hall)		×
gilberti (Meek)		×
hamiltonensis Ulrich		
incisurata (Hall)		
? invertis (Hall)		×
limata (Hall and Simpson)		
linearis (Hall)		×
meeki (Nicholson)		×
ovata (Hall and Simpson)		
ovatipora (Hall)		
perarcta (Hall)		×
recta (Hall and Simpson)		
rectilinea (Hall and Simpson)		
rigida (Hall)		×
semistriata (Hall)		×
sinuosa (Hall)		
subrigida (Hall)		
sulcata (Winchell)		
trilineata (Hall and Simpson)		

Liste of species—Continued.

DEVONIAN—Continued.

	Oriskany.	Upper Held.	Hamilton.
Cystodictya tumulosa (Hall)			×
vermicula (Hall)			×
Cystopora geniculata Hall			×
Dekayia ? devonica Ulrich			×
Dichotrypa foliata Ulrich			×
Discotrypa ? devonica Ulrich			×
Eridopora ? clivulata (Hall)			×
denticulata (Hall)			×
Eridotrypa appressa (Ulrich)			×
? obliqua (Ulrich)			×
Euspilopora ? barrisi Ulrich			×
lobata (Hall and Simpson)			×
palmipes (Hall)			×
serrata Ulrich			×
Favicella inclusa (Hall)			×
tessellata (Hall and Simpson)			×
Fenestella æqualis Hall			×
angustata Hall			×
arkonensis Whiteaves			×
assita Hall			×
biseriata Hall		×	
clathrata Hall and Simpson		×	
cultrata Hall			×
curvata Hall			×
curvijunctura Hall			×
depressa Hall			×
dilata Prout			×
dispanda Hall		×	
emaciata Hall			×
? erectipora Hall		×	
eximia Winchell			×
filitexta Winchell			×
magnifica Nicholson		×	
marcida Hall			×
marginalis Nicholson		×	
? nexilis Hall		×	
nicholsoni Whiteaves			×
nodosa Prout			×
parallela Hall		×	

Lists of species—Continued.

DEVONIAN—Continued.

	Oriskany.	Upper Held.	Hamilton.
Fenestella peculiaris Hall		×	
perplexa Hall			×
planiramosa Hall			×
proceritas Hall and Simpson		×	
proutana Miller			×
pulchella Ulrich			×
quadrangula Hall			×
serrata Hall			×
singularitas Hall			×
sinuosa Hall		×	
spissa Hall			×
stellata Hall			×
tenella Hall			×
tuberculata Hall and Simpson		×	
variapora Hall			×
vera Ulrich			×
verrucosa Hall			×
Fenestrapora biperforata Hall			×
infraporosa (Ulrich)			×
occidentalis Ulrich			×
Fistulipora acervulosa Rominger			×
alternata (Hall)			×
astrica Ulrich			×
? bullata (Hall and Simpson)			×
colliculata (Hall)			×
? confusa (Hall and Simpson)			×
? constricta (Hall)			×
conulata (Hall)			×
cornuta (Hall and Simpson)			×
(?Dichotrypa) corrugata Ulrich			×
cultellata (Hall)			×
distensa (Hall)			×
eriensis Rominger			×
foliacea (Hall)			×
foordi Ulrich			×
geometrica (Hall)			×
granifera (Hall)			×
?? helios Rominger		×	
? hemispherica (Hall)			×

Lists of species—Continued.

DEVONIAN—Continued.

	Oriskany.	Upper Held.	Hamilton.
ora huronensis (Nicholson)			×
incrassata (Nicholson)			×
interaspera Hall and Simpson			×
labiosa Winchell			×
? lamellata (Hall)		×	
longimacula (Hall)			×
monticulata Ulrich			×
normalis Ulrich			×
ovata (Hall)			×
? permarginata (Hall)		×	
? pustulosa (Hall and Simpson)			×
ramosa (Hall and Simpson)			×
romingeri Nicholson and Foord			×
saffordi Winchell			×
? scrobiculata (Hall)			×
spinulifera Rominger			×
subcava (Hall)			×
substellata (Hall)			×
subtrigona (Hall and Simpson)			×
sulcata Rominger			×
? triangularis (Hall)			×
? trifaria Hall and Simpson			×
? umbilicata (Hall)			×
? unilinea Hall and Simpson			×
utriculus Rominger			×
vesiculata Hall and Simpson			×
rypa paliformis (Hall)			×
lla alternata (Hall and Whitfield)			×
canadensis (Nicholson)		×	×
cirrhosa Hall			×
conferta (Hall)			×
filiformis (Billings)			×
magna Hall			×
ora ulrichi Claypole			×
ypa biordo Hall		×	
columellata (Hall and Simpson)		×	
cribrosa (Hall)			×
favosa (Hall)		×	
tenera Ulrich			×

Lists of species—Continued.

DEVONIAN—Continued.

	Oriskany.	Upper Held.	Hamilton.
Hernodia humifusa Hall			×
Heterotrypa ? barrandei (Nicholson)			×
? moniliformis (Nicholson)			×
Intrapora puteolata Hall			×
Isotrypa conjunctiva (Hall)		×	
consimilis Hall		×	
Leptotrypa ? quadrangularis (Nicholson)			×
Lichenotrypa longispina (Hall)			×
Lioclema confertiporum (Hall)			×
decipiens (Hall)			×
densum (Hall)			×
digitatum (Hall)			×
intercellatum (Hall)			×
involvens (Hall and Simpson)			×
microporum (Hall)			×
minutissimum (Nicholson)			×
minutum (Rominger)			×
multaculeatum (Hall)			×
occidens (Hall and Whitfield)			×
punctillatum (Winchell)			×
segregatum (Hall)			×
spheroideum (Hall)			×
subtile (Hall)			×
Loculipora circumstata (Hall and Simpson)		×	
perforata (Hall)			×
Meekopora stellifera (Rominger)			×
Monotrypa ? amplectens Grabau			×
Monotrypella ? unjiga Whiteaves			×
Monticulipora ? monticula (White)			×
? winchelli Ulrich			×
Nemataxis fibrosus Hall		×	
? simplex Hall and Simpson			×
Orthopora bispinulata (Hall)			×
carinata Hall and Simpson			×
elongata (Hall and Simpson)			×
granifera (Hall and Simpson)			×
hexagona (Hall and Simpson)			×
immersa (Hall and Simpson)			×
interplana (Hall and Simpson)			×

Lists of species—Continued.

DEVONIAN—Continued.

	Oriskany.	Upper Held.	Hamilton.
ra lineata (Hall and Simpson)			×
orbipora (Hall)			×
ornata (Hall and Simpson)			×
polygona (Hall)			×
regularis (Hall)			×
reticulata (Hall and Simpson)			×
rhombifera (Hall)			×
scutulata (Hall)		×	
subquadrata (Hall)			×
tortalinea (Hall)			×
transversa (Hall)			×
ıra ? intercella Hall			×
? pertenuis Hall			×
? reticulata Hall			×
? variacella Hall			×
ypa compressa Ulrich			×
delicata Ulrich			×
ɔora cristata (Hall)			×
ɔra aspera Ulrich			×
ypa elegans (Rominger)			×
marginata Whiteaves			×
operculata (Hall and Simpson)			×
plana (Hall)			×
serrulata (Hall)			×
stellata (Hall)			×
variapora (Hall)			×
ɔora carinata (Hall)			×
nodata (Hall)		×	
sinuosa (Hall)		×	
tenuistriata (Hall)		×	
a aculeata (Hall)			×
arkonensis Miller			×
aspectans (Hall)			×
blandida Ulrich			×
brevisulcata (Hall)		×	
carinella (Hall and Simpson)		×	
celsipora (Hall)		×	
celsipora-minima Hall			×
celsipora-minor Hall		×	

Lists of species—Continued.

DEVONIAN—Continued.

	Oriskany.	Up He
Polypora crebrescens (Hall)		×
cylindracea (Hall)		×
distans (Hall)		×
elongata (Hall)		×
fistulata (Hall)		
flabelliformis (Hall)		×
granilinea (Hall)		×
hexagonalis (Hall)		×
hexagonalis-foraminulosa (Hall)		×
intermedia Prout		
lævistriata (Hall)		
largissima (Hall)		×
latitruncata (Hall)		
levinodata (Hall)		
manitobensis Whiteaves		
multiplex (Hall)		
mutabilis (Hall)		×
nexa (Hall)		×
perangulata (Hall)		×
porosa (Hall)		×
propria (Hall)		×
? psyche Billings	×	
pulchella Nicholson		×
quadrangularis (Hall)		
rigida (Hall)		×
robusta (Hall)		×
rustica (Hall and Simpson)		×
separata (Hall and Simpson)		×
shumardi Prout		
striatopora (Hall)		
submutans (Hall)		
tenella Nicholson		×
transversa Ulrich		
Prismopora dilatata Hall		
lata Hall and Simpson		
paucirama Hall		×
sparsipora (Hall)		
triquetra Hall		
Proboscina ? laxa Whiteaves		

Lists of species—Continued.

DEVONIAN—Continued.

	Oriskany.	Upper Held.	Hamilton.
Ptilocella parallela (Hall and Simpson)			×
Ptilodictya gigantea (Nicholson)		×	
?? tarda Billings	×		
Ptilopora infrequens (Hall and Simpson)			×
nodosa (Hall)			×
striata Hall			×
Ptiloporella bifurca (Ulrich)			×
inæqualis (Hall and Simpson)		×	
laticrescens (Hall and Simpson)		×	
Ptiloporina conica (Hall and Simpson)		×	
disparilis (Hall and Simpson)		×	
pinnata (Hall and Simpson)		×	
sinistralis (Hall and Simpson)		×	
Reptaria nodata (Hall)			×
stolonifera Rolle			×
Reteporidra adnata (Hall)			×
cinctuta (Hall)			×
perundata (Hall)			×
Reteporina coalescens (Hall and Simpson)		×	
hamiltonensis (Prout)			×
perundulata (Hall)			×
phillipsi (Nicholson)		×	
prisca (Goldfuss?) (Nicholson)		×	×
rhombifera (Hall)		×	
striata (Hall)			×
Rhombopora lineinodis Ulrich			×
lineinodis-humilis Ulrich			×
subannulata Ulrich			×
sulcifera Ulrich			×
Scalaripora approximata Ulrich			×
canadensis Whiteaves			×
scalariformis Hall			×
separata Ulrich			×
subconcava Hall			×
Selenopora circincta (Hall)			×
complexa (Hall)			×
Semicoscinium biimbricatum (Hall)			×
biserrulatum Hall			×
davidsoni (Nicholson)			×

Lists of species—Continued.

DEVONIAN—Continued.

	Oriskany.	Upper Held.	Hamilton
Semicoscinium eriense Prout			
exornatum (Hall)			×
graniferum (Hall)		×	
hindei (Nicholson)		×	
inflexum (Hall)			×
interruptum (Hall)			×
labiatum (Hall)			×
latijuncturum (Hall)			×
lunulatum (Hall)			×
mirabile (Nicholson)		×	
permarginatum (Hall)			×
planidorsatum Ulrich			×
rhombicum Ulrich			×
rhomboideum Prout			×
semirotundum (Hall)			×
subtortile (Hall)			×
tortum (Hall)			×
tuberculatum (Prout)			×
Semiopora bistigmata Hall			×
Stictopora ?? divergens Hall and Simpson			×
?? fruticosa Hall		×	
?? granifera Hall			×
?? incrassata Hall			×
?? interstriata Hall			×
?? permarginata Hall			×
?? striata Hall and Simpson			×
Stictoporina claviformis (Hall)			×
plumea (Hall and Simpson)			×
scutulata (Hall)			×
Stomatopora ?? moniliformis Whiteaves			×
Streblotrypa hamiltonensis (Nicholson)			×
scutulata (Hall)			×
Strotopora perminuta Ulrich			×
Tæniodictya ? rhomboidea (Hall)		×	
Tæniopora exigua Nicholson			×
occidentalis Ulrich			×
penniformis Nicholson			×
recubans (Hall and Simpson)			×
subcarinata (Hall)			×

Lists of species—Continued.

DEVONIAN—Continued.

	Oriskany.	Upper Held.	Hamilton.
iscus multiramus Hall		×	
nanus Hall			×
pauciramus Hall			×
otrypa divaricata (Hall)		×	
ella annulata (Hall)			×
arborea (Hall)			×
glomerata (Hall)		×	
nodosa (Hall and Simpson)			×
perspinulata (Hall)			×
ppora nana Hall		×	
a acaulis (Hall)			×
acclivis (Hall and Simpson)		×	
anonyma (Hall)			×
? elegantissima (Hall)		×	
fastigata (Hall)			×
ficticia (Hall and Simpson)		×	
lata (Hall)		×	
nana (Hall and Simpson)		×	
pernodosa (Hall)		×	
scalaris (Hall)			×
substriata (Hall)		×	
tegulata (Hall)			×

MISSISSIPPIAN.

	Kl.	Osage.			St. Louis.			Ch.
		Wav.	Bur.	Keo.	War.	St. L.	Ste. G.	
oclema confluens (Ulrich)		×		×				
rypa peculiaris (Romin-				×				
ypa fistulosa Ulrich							×	
ramulosa Ulrich							×	
solida Ulrich								×
symmetrica Ulrich								×
edes communis Ulrich								×
compactus Ulrich								×
distans Ulrich								×
grandis Ulrich				×				
intermedius Ulrich								×

Lists of species—Continued.

MISSISSIPPIAN—Continued.

	Ki.	Osage.			St. Louis.			Ch.
		Wav.	Bur.	Keo.	War.	St. L.	Ste. G.	
Archimedes invaginatus Ulrich								×
laxus (Hall)								×
meekanus (Hall)								×
negligens Ulrich				×				
owenanus (Hall)				×				
perminimus Ulrich								×
proutanus Ulrich								×
sublaxus Ulrich								×
swallovanus (Hall)								×
terebriformis Ulrich								×
wortheni (Hall)					×			
Bactropora simplex Ulrich				×				
Batostomella abrupta Ulrich								×
interstincta Ulrich							×	
nitidula Ulrich								×
spinulosa Ulrich								×
Berenicea ? insueta Dawson								
Chilotrypa hispida Ulrich								×
Cœloconus granosus Ulrich								×
rhombicus Ulrich					×			
Coscinium latum Ulrich			×					
Cyclopora expatiata Ulrich				×				
fungia Prout		×		×				
Cycloporella ? perversa Ulrich				×				
spinifera Ulrich				×				
Cystodictya americana Ulrich				×				
angusta Ulrich		×						
lineata Ulrich				×				
lineata-major Ulrich						×		
lineata-sancti-ludovici Ulrich						×		
nitida Ulrich				×				
ocellata Ulrich				×				
pustulosa Ulrich				×				
simulans Ulrich		×		×				
zigzag Ulrich		×		×				
Dichotrypa elegans Ulrich						×		
expatiata Ulrich						×		
flabellum (Rominger)						×		

Lists of species—Continued.

MISSISSIPPIAN—Continued.

	Ki.	Osage.			St. Louis.			Ch.
		Wav.	Bur.	Keo.	War.	St. L.	Ste. G.	
ypa intermedia Ulrich						×		
lyroides Ulrich						×		
raria bifurcata Ulrich								×
ra macrostoma Ulrich								×
punctifera Ulrich								×
opora grandis Meek and Worthen			×					
quinqueradiata Ulrich			×					
radiata Meek and Worthen				×				
sexradiata Meek and Worthen			×					
la albida Hall		×						
aperta Hall		×						
banyana Prout					×			
burlingtonensis Ulrich		×	×					
cavernosa Ulrich		×						
cestriensis Ulrich								×
cingulata Ulrich				×				
compressa Ulrich				×				
delicata Meek		×						
elevatipora Ulrich								×
exigua Ulrich					×			
filistriata Ulrich			×					
foliata Ulrich		×						
funicula Ulrich				×				
herrickana Ulrich		×						
limitaris Ulrich				×				
lodiensis Meek		×						
meekana Ulrich		×						
multispinosa Ulrich				×				
nododorsalis Ulrich				×				
regalis Ulrich				×				
regalis-macra Ulrich				×				
richfieldensis Ulrich		×						
rudis Ulrich				×	×			
serratula Ulrich				×	×	×		×
subflexuosa Ulrich		×						
tenax Ulrich		×			×			×

Lists of species—Continued.

MISSISSIPPIAN—Continued.

	Ki.	Osage.			St. Louis.			Ch.
		Wav.	Bur.	Keo.	War.	St. L.	Ste. G.	
Fenestella triserialis Ulrich				×				
Fenestralia compacta Ulrich						×		
sancti-ludovici Prout					×	×		
Fistulipora asteria (Prout)				×				
compressa Rominger				×				
excellens Ulrich								×
prolifica Ulrich						×		
spergenensis Rominger					×			
? tuberculata Prout				×				
Glyptopora elegans (Prout)					×			
keyserlingi (Prout)				×				
michelinia (Prout)					×			
plumosa (Prout)					×			
punctipora Ulrich								×
sagenella (Prout)				×	×			
sagenella-caliculosa Ulrich					×			
sagenella-lata Ulrich					×			
Heliotrypa bifolia Ulrich								×
Hemitrypa aspera Ulrich				×				
nodosa Ulrich				×				
pateriformis Ulrich				×				
perstriata Ulrich				×				
plumosa (Prout)					×			
proutana Ulrich				×	×	×		
proutana-nodulosa Ulrich				×				
proutana-vermifera Ulrich					×			
Intrapora basalis (Ulrich)					×			
undulata (Ulrich)								×
Lioclema ? araneum Ulrich								×
foliatum Ulrich					×			
gracillimum Ulrich	×	×	×	×	×			
punctatum (Hall)		×		×	×	×		
subglobosum Ulrich	×							
wachsmuthi Ulrich	×							
Lyropora divergens Ulrich								×
ovalis Ulrich								×
quincuncialis (Hall)								×

Lists of species—Continued.

MISSISSIPPIAN—Continued.

	Ki.	Osage.			St. Louis.			Ch.
		Wav.	Bur.	Keo.	War.	St. L.	Ste. G.	
ranosculum Ulrich								×
retrorsa (Meek and Worthen)			×					
subquadrans (Hall)								×
subquadrans-lyra (Hall)								×
ra ? aperta Ulrich				×				
approximata Ulrich								×
clausa (Ulrich)								×
eximia Ulrich						×		×
ora megastoma (Ulrich)		×		×				
pinnata (Ulrich)			×					
trifolia (Rominger)				×				
ora conferta Ulrich				×				
curvata Ulrich		×						
flexuosa Ulrich				×				
intermedia Ulrich		×						
minor Ulrich		×						
simulatrix Ulrich		×						
striata Ulrich				×				
subangulata Ulrich		×						
tenuiramosa Ulrich		×						
vinei Ulrich		×		×				
youngi Ulrich		×		×				
approximata Ulrich								×
biseriata Ulrich					×			
burlingtonensis Ulrich			×					
cestriensis Ulrich								×
complanata Ulrich								×
corticosa Ulrich								×
? gracilis Prout				×				
halliana Prout				×	×			
impressa Ulrich		×						
maccoyana Ulrich				×				
radialis Ulrich		×		×				
retrorsa Ulrich				×				
simulatrix Ulrich				×				
spininodata Ulrich					×			
spinulifera Ulrich								×

Lists of species—Continued.

MISSISSIPPIAN—Continued.

	Ki.	Osage.			St. Louis.			Ch.
		Wav.	Bur.	Keo.	War.	St. L.	Ste. G.	
Polypora tuberculata Prout								×
varsoviensis Prout					×			
Prismopora serrulata Ulrich								×
Proutella discoidea (Prout)				×				
Ptilopora acuta Ulrich			×	×				
cylindracea Ulrich				×				
paupera Ulrich		×		×				
prouti Hall					×			
valida Ulrich				×				
Reteporina flexuosa (Ulrich)								×
Rhombopora angustata Ulrich				×				
armata Ulrich								×
? asperula Ulrich				×				
attenuata Ulrich				×				
decipiens Ulrich						×		
dichotoma Ulrich			×	×				
elegantula Ulrich				×				
exigua Ulrich			×					
gracilis Ulrich			×					
incrassata Ulrich		×		×				
minor Ulrich								×
ohioensis Ulrich		×						
persimilis Ulrich								×
pulchella Ulrich								×
simulatrix Ulrich						×		
? spiralis Ulrich				×				
tabulata Ulrich								×
tenuirama Ulrich								×
transversalis Ulrich				×				
varians Ulrich				×				
wortheni Ulrich						×		
Septopora biserialis-nervata Ulrich								×
cestriensis Prout								×
decipiens Ulrich								×
rectistyla (Whitfield)								×
robusta-intermedia Ulrich								×
subquadrans Ulrich								×
Sphragiopora parasitica Ulrich								×

Lists of species—Continued.

MISSISSIPPIAN—Continued.

	Ki.	Osage.			St. Louis.			Ch.
		Wav.	Bur.	Keo.	War.	St. L.	Ste. G.	
a americana Ulrich				×				
americana-varsoviensis Ulrich					×			
angularis Ulrich				×				
cestriensis Ulrich								×
emaciata Ulrich				×				
intercalaris Ulrich				×				
intermittens Ulrich				×				
meekana Ulrich								×
montifera Ulrich				×				
ramosa Ulrich								×
rudis Ulrich								×
tuberculata (Prout)					×	×		×
ypa amplexa Ulrich		×						
(? Lioclema) denticulata Ulrich		×						
distincta Ulrich								×
hertzeri Ulrich		×		×				
major Ulrich		×		×				
multiporata Ulrich		×						
nicklesi Ulrich								×
obliqua Ulrich		×						
radialis Ulrich				×				
regularis Ulrich		×						
striata Ulrich		×						
subspinosa Ulrich								×
a dermata Ulrich				×				
foveolata Ulrich				×				
tya cingulata Ulrich				×				
frondosa Ulrich				×				
interpolata Ulrich		×						
ramulosa Ulrich				×				
ramulosa-burlingtonensis Ulrich			×					
subrecta Ulrich						×		
cus divaricans Ulrich				×				
furcillatus Ulrich								×
ramulosus Ulrich								×
sculptilis Ulrich				×				

Lists of species—Continued.

MISSISSIPPIAN—Continued.

	Ki.	Osage.			St.	
		Wav.	Bur.	Keo.	War.	S
Trematopora ? ? americana Miller			×			
? ? fragilis Winchell			×			
? ? vesiculosa Winchell		×	×			
Worthenopora spatulata (Prout)					×	
spinosa Ulrich				×		

CARBONIFEROUS.

	M
Acanthocladia fruticosa Ulrich	
Chainodictyon laxum Foerste	
laxum-minor Ulrich	
Coscinium dictyotum (Meek)	
Cystodictya carbonaria (Meek)	
? concentrica (Prout)	
Diploporaria biserialis Ulrich	
Fenestella conradi Ulrich	
corticata Prout	
delicatula Ulrich	
inæqualis Ulrich	
intermedia Prout	
limbata Foerste	
lyelli Dawson	
mimica Ulrich	
modesta Ulrich	
norwoodiana Prout	
perelegans Meek	
perminuta Ulrich	
popeana Prout	
remota Foerste	
sevillensis Ulrich	
shumardi Prout	
subretiformis Prout	
trituberculata Prout	
variabilis Prout	
wortheni Ulrich	

Lists of species—Continued.

CARBONIFEROUS—Continued.

	Coal Measures.	Permian.
a carbonaria Ulrich	×	
nodulifera Meek	×	
ra bellula Ulrich	×	
nereidis (White)		
trilineata (Meek)	×	
whitii Foerste	×	
crassa Ulrich	×	
distincta Ulrich	×	
mexicana Prout		×
nodocarinata Ulrich	×	
spinulifera Ulrich	×	
stragula White		
submarginata Meek	×	
whitei Ulrich	×	
whitei-insculpta Ulrich	×	
a minima Ulrich	×	
? serrata Meek	×	
triangulata (White)	×	
ora crassa Ulrich	×	
exilis (Dawson)		
lepidodendroides Meek	×	
multipora Foerste	×	
nicklesi Ulrich	×	
biserialis (Swallow)	×	
biserialis-gracilis (Meek)	×	
biserialis-nervata Ulrich	×	
delicatula Ulrich	×	
pinnata Ulrich	×	
robusta Ulrich	×	
carbonaria (Worthen)	×	
carbonaria-conferta Ulrich	×	
carbonaria-maculosa Ulrich	×	
ohioensis Foerste	×	
? signata Ulrich	×	
pa prisca (Gabb and Horn)		
s octonarius Ulrich	×	
sevillensis Ulrich	×	

TABLES OF GENERA AND SPECIES.

These tables show the number of species of the various
ent in the different geologic formations. The tables of
and Cincinnati periods show also the number of species
two or more of the divisions and those restricted to one di

TRENTON.

	Stones R.	Stones R. and Black R.	Black R.	Black R. and Trenton.	Trenton.	Stones R., Black R., Trenton.
CTENOSTOMATA.						
Ascodictyonidæ:						
Vinella			1			
CYCLOSTOMATA.						
Diastoporidæ:						
Stomatopora				1	2	1
Proboscina				1		
Berenicea		1				
Diastoporina					1	
Idmoneidæ:						
Protocrisina					1	
Entalophoridæ:						
Mitoclema	1					1
Diploclema						1
Phaceloporidæ:						
Phacelopora						1
Ceramoporidæ:						
Ceramoporella						1
Crepipora	1		1		1	
Cœloclema					1	
Anolotichia	1					
Ceramophylla			1			
Bythotrypa						1
Scenellopora	1					
Spatiopora			2		1	
TREPOSTOMATA.						
Monticuliporidæ:						
Monticulipora	1		1	1	3	
Atactoporella			3		1	
Homotrypella			3	1	2	
Homotrypa	3	1	4		3	

Tables of genera and species—Continued.

TRENTON—Continued.

	Stones R.	Stones R. and Black R.	Black R.	Black R. and Trenton.	Trenton.	Stones R., Black R., Trenton.	Into Cincinnati.	Total.
OMATA—Continued.								
poridæ:								
pora[1]	......	......	3	1	8	......	......	13
opora	......	1	......	......	2	......	......	3
rypa	......	......	2	......	6	......	......	8
oridæ:								
exopora	......	......	......	......	1	......	......	1
pidæ:								
vella	......	1	4	......	1	......	......	6
trypa	2	......	1	......	1	......	......	4
llidæ:								
opora	......	......	2	......	......	......	......	2
trypa	......	......	......	......	5	......	......	5
iidæ:								
ellaria	......	......	......	......	2	......	......	2
oora	......	......	......	......	1	......	......	1
lsonella	2	......	1	......	......	......	......	3
oridæ:								
atopora	......	......	3	......	2	......	......	5
oma	2	1	7	1	2	......	......	13
phragma	......	......	......	1	1	1	......	3
atotrypa	......	1	......	......	......	......	......	1
trypa	1	......	......	......	4	......	......	5
rypa	......	......	......	......	3	......	......	3
læ:								
oora	2	1	3	3	1	......	......	10
YPTOSTOMATA.								
inidæ:								
oporina	1	......	1	1	5	......	......	8
otrypa	......	......	......	......	1	......	......	1
lidæ:								
ostylus	1	......	1	......	1	......	......	3
ora	2	......	1	......	2	......	......	5
oclema	......	......	2	......	3	......	......	5
topora	......	......	......	......	7	......	......	7

[1] One species Stones River and Trenton.

Tables of genera and species—Continued.

TRENTON—Continued.

	Stones R.	Stones R. and Black R.	Black R.	Black R. and Trenton.	Trenton.	Stones R., Black R., Trenton.	Into Cincinnati.	Total.
CRYPTOSTOMATA—Continued.								
Ptilodictyonidæ:								
Escharopora	4	1	2		2			9
Phænopora					1			1
Arthropora		1	1		1			3
Stictoporellidæ:								
Stictoporella	3	1	2		2			8
Stictopora	2				1			3
Rhinidictyonidæ:								
Rhinidictya	7	1	3		4	1		16
Eurydictya				1	1			2
Pachydictya	3		2		6			11
Phyllodictya	1		1					2
Trigonodictya			1					1
Total	41	11	59	12	93	8	1	226

CINCINNATI.

	Utica.	Utica and Lorraine.	Lorraine.	Lorraine and Richmond.	Richmond.	Utica, Lorraine, Richmond.	Utica, Richmond.	Total.
CTENOSTOMATA.								
Rhopalonariidæ:								
Rhopalonaria				1				1
Ascodictyonidæ:								
Vinella			1					1
CYCLOSTOMATA.								
Diastoporidæ:								
Stomatopora	1			1	1	2		5
Proboscina	1			2				3
Berenicea	1			1				2
Idmoneidæ:								
Protocrisina					1			1
Ceramoporidæ:								
Ceramoporella	1	1		1	3	1		7
Crepipora	2		2		1			5
Chiloporella			1					1

Tables of genera and species—Continued.

CINCINNATI—Continued.

	Utica.	Utica and Lorraine.	Lorraine.	Lorraine and Richmond.	Richmond.	Utica, Lorraine, Richmond.	Utica, Richmond.	Total.
TOMATA—Continued.								
oridæ—Continued.								
oclema	2		1					3
lotichia					1			1
notrypa					1			1
iopora	1		3	2	1			7
'REPOSTOMATA.								
liporidæ:								
ticulipora			3		5			8
toporella	2		4		1			7
nopora			1	1				2
notrypella					2			2
notrypa			2	2	1			5
opora					1			1
dopora	3							3
otrypa					1			1
pporidæ:								
lexopora	2	1	4		1			8
otrypella	1				3			4
otrypa			1					1
ypidæ:								
erotrypa			5		4			9
ayella	3							3
ayia	1		4					5
gopora			3		1			4
otrypa	2		7		1			10
topora		1	1					2
nellidæ:								
nopora	2		2		3			7
otrypa					1			1
lema					1			1
lemella					5			5
ariidæ:								
stellaria		1	2		4			7
nolsonella			1		1			2
poridæ:								
stoma	2				3			5
niphragma	1				1			2

Tables of genera and species—Continued.

CINCINNATI—Continued.

	Utica.	Utica and Lorraine.	Lorraine.	Lorraine and Richmond.	Richmond.	Utica, Lorraine, Richmond.	Utica, Richmond.	Total.
TREPOSTOMATA—Continued.								
Trematoporidæ—Continued.								
Monotrypa	1				2			3
Diplotrypa					1			1
Calloporidæ:								
Callopora	4		5		1			10
Calloporella					3			3
CRYPTOSTOMATA.								
Phylloporinidæ:								
Phylloporina	1		1					2
Fenestellidæ:								
Fenestella					1			1
Arthrostylidæ:								
Arthrostylus	2							2
Helopora					3			3
Arthroclema					1			1
Sceptropora					1			1
Ptilodictyonidæ:								
Ptilodictya					6			6
Escharopora	1		4					5
Phænopora					1			1
Arthropora	1		1					2
Graptodictya					1			1
Stictoporellidæ:								
Stictoporella	1							1
Ptilotrypa					1			1
Rhinidictyonidæ:								
Rhinidictya	1				1			2
Eurydictya					2			2
Pachydictya					6			6
Dicranopora			1	1	2			4
Goniotrypa					1			1
CHILOSTOMATA.								
Palescharidæ:								
Paleschara							1	1
Total	40	4	60	12	83	3	1	203

Genera with number of species present in Paleozoic formations.

	Ordovician.			Silurian.				Devonian.			Mississippian.				Carbon.		Total species.
	Chz.	Tr.	Cin.	An.	Cl.	Nl.	L. H.	Or.	U. H.	Ha.	Kl.	Os.	S. L.	Ch.	C. M.	Per.	
CTENOSTOMATA.																	
Rhopalonariidæ:																	
Rhopalonaria			1														1
Ascodictyonidæ:																	
Ascodictyon										2							2
Vinella		1	1			1											3
CYCLOSTOMATA.																	
Diastoporidæ:																	
Stomatopora		4	5			2											8
Proboscina		1	3							1							5
Berenicea		1	2			2											6
Diastoporina		1															1
Hederella									1	6							6
Hernodia										1							1
Reptaria										2							2
Idmoneidæ:																	
Crisinella									1								1
Protocrisina		1	1														1
Entalophoridæ:																	
Mitoclema		2															2
Clonopora									2	1							3
Diploclema		1				1											2
Cystopora										1							1
Phaceloporidæ:																	
Phacelopora		1															1
Ceramoporidæ:																	
Ceramopora					1	6	3										10
Ceramoporella		2	7														9
Crepipora		4	5														8
Chiloporella			1														1
Cœloclema		1	3														4
Anolotichia		1	1														2
Ceramophylla		1															1
Bythotrypa		1	1														2
Scenellopora		1															1
Spatiopora		3	7														10
Fistuliporidæ:																	
Fistulipora						4	6		2	43		3	2	1	2		62
Cyclotrypa										2							2
Eridopora										2				2			4
Pinacotrypa										7							7
Chilotrypa						4	2		1					1			8
Strotopora										1		2					3
Meekopora						1				1		1	1	3			6
Lichenotrypa										1							1
Buskopora									1	3							4
Glossotrypa										1							1
Selenopora										2							2
Favicella										2							2
Cœlocaulis							2		1								3
Botrylloporidæ:																	
Botryllopora										1							1

Genera with number of species present in Paleozoic formations—Continued.

	Ordovician.			Silurian.				Devonian.			Mississippian.				Carbon.		Total species.
	Chz.	Tr.	Cin.	An.	Cl.	Ni.	L. H.	Or.	U. H.	Ha.	Kl.	Os.	S. L.	Ch.	C. M.	Per.	
TREPOSTOMATA.																	
Monticuliporidæ:																	
Monticulipora		6	8							2							16
Atactoporella		4	7														11
Peronopora			2														2
Homotrypella		6	2														8
Homotrypa		11	5		1	1											18
Prasopora		13	1														14
Aspidopora		3	3		2												8
Mesotrypa		8	1			1											10
Amplexoporidæ:																	
Amplexopora		1	8														8
Monotrypella			4			1	3			1							9
Petalotrypa										2							2
Discotrypa			1							1							2
Heterotrypidæ:																	
Heterotrypa			9							2							11
Dekayella		6	3														9
Dekayia			5							1							6
Petigopora			4														4
Leptotrypa		4	10			1				1							16
Atactopora			2														2
Batostomellidæ:																	
Batostomella						2							1	3			6
Bythopora		2	7			1											10
Callotrypa							7		2	1							10
Trematella									1	4							5
Eridotrypa		5	1			1	1			2							10
Stenopora												6	2	4	5		17
Anisotrypa													2	2			4
Lioclema			1			4	3			15	2	2	3	1			29
Lioclemella			5		1												6
Constellariidæ:																	
Constellaria		2	7														9
Stellipora		1															1
Nicholsonella		3	2														5
Idiotrypa						1											1
Trematoporidæ:																	
Trematopora		5				5											10
Batostoma		13	5														18
Hemiphragma		3	2														5
Stromatotrypa		1															1
Monotrypa		5	3				6			1							15
Diplotrypa		3	1														4
Calloporidæ:																	
Callopora		10	10		1	1	1										23
Calloporella			3														3
CRYPTOSTOMATA.																	
Phylloporinidæ:																	
Phylloporina	3	8	2		1	1											15
Drymotrypa		1				2	1										4

Genera with number of species present in Paleozoic formations—Continued.

	Ordivician.			Silurian.				Devonian.			Mississippian.				Carbon.		Total species.
	Chz.	Tr.	Cin.	An.	Cl.	Ni.	L. H.	Or.	U. H.	Ha.	Ki.	Os.	S. L.	Ch.	C. M.	Per.	
CRYPTOSTOMATA—Cont'd.																	
Fenestellidæ:																	
Fenestella			1		1	7	14		12	28		23	5	4	19	1	111
Semicoscinium						2	3		4	17							26
Fenestrapora										3							3
Isotrypa									2								2
Loculipora						1	1		1	1							4
Unitrypa							4		7	5							16
Hemitrypa					1		2		3	2		6	3				16
Helicopora						1				1							2
Archimedes												3	1	12			16
Polypora						5	10	1	24	17		8	4	6	8	1	82
Lyropora												1		6			7
Fenestralia													2				2
Thamniscus						1	3		1	2		2		2	2		13
Phyllopora										1							1
Reteporidra									1	3							3
Reteporina									4	4				1			8
Ptiloporella						1			2	1							4
Ptiloporina									4								4
Acanthocladiidæ:																	
Pinnatopora									3	1		11			4		19
Acanthocladia															1		1
Septopora														6	6		11
Ptilopora										3		4	1				8
Ichthyorachis							1										1
Diploporaria														1	1		2
Sphragioporidæ:																	
Sphragiopora														1			1
Arthrostylidæ:																	
Arthrostylus		3	2														4
Helopora		5	3	3	1	1											12
Arthroclema		5	1														6
Sceptropora			1		1												2
Nematopora		7		5	1	3											15
Rhabdomesontidæ:																	
Rhombopora										3		12	3	6	5		29
Rhabdomeson																	
Cœloconus													1	1			2
Bactropora										2		1					3
Orthopora							8		1	17							26
Acanthoclema									4	1		1					6
Nemataxis									1	1							2
Tropidopora									1								1
Streblotrypa										2		9		3	1		15
Chainodictyonidæ:																	
Chainodictyon															2		2
Ptilodictyonidæ:																	
Ptilodictya			6	3	4	1	1		1								16
Escharopora		9	5														14
Clathropora					2	3			1								5
Phænopora		1	1	2	8		2										14

Genera with number of species present in Paleozoic formations—Continued.

	Ordovician.			Silurian.			Devonian.				Mississippian.				Carbon.		Total species.
	Chz.	Tr.	Cin.	An.	Cl.	Ni.	L. H.	Or.	U. H.	Ha.	Ki.	Os.	S. L.	Ch.	C. M.	Per.	
CRYPTOSTOMATA—Cont'd.																	
Ptilodictyonidæ—Cont'd.																	
Arthropora		3	2														5
Graptodictya			1														1
Stictoporina										3							3
Stictoporellidæ:																	
Stictoporella		8	1														9
Ptilotrypa			1														1
Intrapora										1		1		1			3
Coscinella										2							2
Tæniodictya									1			5	1				7
Stictopora	1	3															4
Heliotrypa														1			1
Rhinidictyonidæ:																	
Rhinidictya	1	16	2														19
Eurydictya		2	2														4
Pachydictya		11	6	2	7	1											25
Phyllodictya		2															2
Euspilopora										4							4
Dicranopora			4	1			1										5
Goniotrypa			1														1
Trigonodictya		1			1												2
Cystodictyonidæ:																	
Cystodictya									8	17		8	2		2		35
Dichotrypa										1			5				6
Coscinium									1	2		1			1		5
Tæniopora										5							5
Thamnotrypa									1								1
Semiopora										1							1
Ptilocella										1							1
Acrogenia										1							1
Prismopora									1	4				1	3		9
Scalaripora										5							5
Glyptopora												2	6	1			8
Phractopora										1		3					4
Ceramella										1							1
Evactinopora												4					4
Actinotrypidæ:																	
Actinotrypa												1					1
Cycloporidæ:																	
Cyclopora												2					2
Cycloporella												2					2
Proutella												1					1
Worthenopora												1	1				2
Rhinoporidæ:																	
Rhinopora					2	1											3
Diamesopora					1	4											5
Lichenalia						1											1
Stictotrypa					1	3											3
CHILOSTOMATA.																	
Palescharidæ:																	
Paleschara			1			3	5			4							13

Genera with number of species present in Paleozoic formations—Continued.

SUMMARY OF SPECIES BY FAMILIES.

	Ordovician.			Silurian.				Devonian.			Mississippian.				Carbon.		Total species.
	Chz.	Tr.	Cin.	An.	Cl.	Nl.	L. H.	Or.	U. H.	Ha.	Ki.	Os.	S. L.	Ch.	C. M.	Per.	
CTENOSTOMATA.																	
Rhopalonariidæ			1														1
Ascodictyonidæ		1	1			1				2							5
CYCLOSTOMATA.																	
Diastoporidæ		7	10			4			1	10							29
Idmoneidæ		1	1						1								2
Entalophoridæ		3				1			2	2							8
Phaceloporidæ		1															1
Ceramoporidæ		14	25		1	6	3										48
Fistuliporidæ						9	10		5	65		6	3	7	2		105
Botrylloporidæ										1							1
TREPOSTOMATA.																	
Monticuliporidæ		51	29		3	2				2							87
Amplexoporidæ		1	13			1	3			4							21
Heterotrypidæ		10	33			1				4							48
Batostomellidæ		7	14		1	8	11		3	22	2	8	8	10	5		97
Constellariidæ		6	9			1											16
Trematoporidæ		30	11			5	6			1							53
Calloporidæ		10	13		1	1	1										26
CRYPTOSTOMATA.																	
Phylloporinidæ	3	9	2		1	3	1										19
Fenestellidæ			1		2	18	37	1	65	85		43	15	31	29	2	20
Acanthocladiidæ							1		3	4		15	1	7	12		42
Sphragioporidæ														1			1
Arthrostylidæ		20	7	8	3	4											39
Rhabdomesontidæ							8		7	26		23	4	10	6		84
Chainodictyonidæ															2		2
Ptilodictyonidæ		13	15	5	14	4	3		2	3							58
Stictoporellidæ	1	11	2						1	3		6	1	2			27
Rhinidictyonidæ	1	32	15	3	8	1	1			4							62
Cystodictyonidæ									11	39		18	13	2	6		86
Actinotrypidæ												1					1
Cycloporidæ												6	1				7
Rhinoporidæ					4	9											12
CHILOSTOMATA.																	
Palescharidæ			1			3	5			4							13

SUMMARY OF SPECIES BY SUBORDERS.

	Chz.	Tr.	Cin.	An.	Cl.	Nl.	L. H.	Or.	U. H.	Ha.	Ki.	Os.	S. L.	Ch.	C. M.	Per.	Total species.
CTENOSTOMATA		1	2			1				2							6
CYCLOSTOMATA		26	36		1	20	13		9	78		6	3	7	2		194
TREPOSTOMATA		115	122		5	19	21		3	33	2	8	8	10	5		348
CRYTOSTOMATA	5	85	42	16	32	39	51	1	89	164		112	35	53	55	2	760
CHILOSTOMATA			1			3	5			4							13
Total	5	227	203	16	38	82	90	1	101	281	2	126	46	70	62	2	1,321

Families with number of genera present in Paleozoic formations.

	Ordovician.			Silurian.				Devonian.			Mississippian.				Carbon.		Total genera.
	Chz.	Tr.	Cin.	An.	Cl.	Ni.	L. H.	Or.	U. H.	Ha.	Ki.	Os.	S.L.	Ch.	C. M.	Per.	
CTENOSTOMATA.																	
Rhopalonariidæ	....	....	1	....	....	....	....	....	....	....	....	....	....	....	....	....	1
Ascodictyonidæ	....	1	1	....	....	1	....	....	....	1	....	....	....	....	....	....	2
CYCLOSTOMATA.																	
Diastoporidæ	....	4	3	....	....	2	....	....	1	4	....	....	....	....	....	....	7
Idmoneidæ	....	1	1	....	....	....	....	....	1	....	....	....	....	....	....	....	2
Entalophoridæ	....	2	....	....	....	1	....	....	1	2	....	....	....	....	....	....	4
Phaceloporidæ	....	1	....	....	....	....	....	....	....	....	....	....	....	....	....	....	1
Ceramoporidæ	....	8	7	....	1	1	1	....	....	....	....	....	....	....	....	....	10
Fistuliporidæ	....	....	....	....	....	3	3	....	4	11	....	3	2	4	1	....	13
Botrylloporidæ	....	....	....	....	....	....	....	....	....	1	....	....	....	....	....	....	1
TREPOSTOMATA.																	
Monticuliporidæ	....	7	8	....	2	2	....	....	....	1	....	....	....	....	....	....	8
Amplexoporidæ	....	1	3	....	....	1	1	....	....	3	....	....	....	....	....	....	4
Heterotrypidæ	....	2	6	....	....	1	....	....	....	3	....	....	....	....	....	....	6
Batostomellidæ	....	2	4	....	1	4	3	....	2	4	1	2	3	3	1	....	9
Constellariidæ	....	3	2	....	....	1	....	....	....	....	....	....	....	....	....	....	4
Trematoporidæ	....	6	4	....	....	1	1	....	....	1	....	....	....	....	....	....	7
Calloporidæ	....	1	2	....	1	1	1	....	....	....	....	....	....	....	....	....	2
CRYPTOSTOMATA.																	
Phylloporinidæ	1	2	1	....	1	2	1	....	....	....	....	....	....	....	....	....	2
Fenestellidæ	....	....	1	....	2	7	7	1	12	13	....	6	5	6	3	2	18
Acanthocladiidæ	....	....	....	....	....	....	1	....	1	2	....	2	1	2	4	....	6
Sphragioporidæ	....	....	....	....	....	....	....	....	....	....	....	....	....	1	....	....	1
Arthrostylidæ	....	4	4	2	3	2	....	....	....	....	....	....	....	....	....	....	5
Rhabdomesontidæ	....	....	....	....	....	....	1	....	4	6	....	4	2	3	2	....	8
Chainodictyonidæ	....	....	....	....	....	....	....	....	....	....	....	....	....	....	1	....	1
Ptilodictyonidæ	....	3	5	2	3	2	2	....	2	1	....	....	....	....	....	....	7
Stictoporellidæ	1	2	2	....	....	....	....	....	1	2	....	2	1	2	....	....	7
Rhinidictyonidæ	1	5	5	2	2	1	1	....	....	1	....	....	....	....	....	....	8
Cystodictyonidæ	....	....	....	....	....	....	....	....	4	11	....	5	3	2	3	....	14
Actinotrypidæ	....	....	....	....	....	....	....	....	....	....	....	1	....	....	....	....	1
Cycloporidæ	....	....	....	....	....	....	....	....	....	....	....	4	1	....	....	....	4
Rhinoporidæ	....	....	....	....	3	4	....	....	....	....	....	....	....	....	....	....	4
CHILOSTOMATA.																	
Palescharidæ	....	....	1	....	....	1	1	....	....	1	....	....	....	....	....	....	1

SUMMARY OF GENERA BY SUBORDERS.

CTENOSTOMATA	....	1	2	....	....	1	....	....	....	1	....	....	....	....	....	....	3
CYCLOSTOMATA	....	16	11	....	1	7	4	....	7	18	....	3	2	4	1	....	38
TREPOSTOMATA	....	22	29	....	4	11	6	....	2	12	1	2	3	3	1	....	40
CRYPTOSTOMATA	3	16	18	6	14	18	13	1	24	36	....	24	13	16	13	2	86
CHILOSTOMATA	....	....	1	....	....	1	1	....	....	1	....	....	....	....	....	....	1
Total	3	55	61	6	19	38	24	1	33	68	1	29	18	23	15	2	168

GENERAL NOTES.

VALUE OF BRYOZOA IN STRATIGRAPHIC WORK.

alue of the bryozoa in stratigraphic work has scarcely yet
o be appreciated. In American Paleozoic strata they are pre-
ly the fossils to be relied upon in correlation work. They are
lways abundant, and even when poorly preserved exteriorly
dentified by microscopic sections. Crinoids and crustacea are
too scarce; mollusca, abundant in some formations, are almost
; in others, and likely to be poorly preserved; vertebrate re-
re too few, and usually local in distribution. The brachiopods
usually abundant in all Paleozoic strata, but have commonly
t a range vertically to be trusty guides in close work.

use to the unaided eye there seems little variation of form
the bryozoa, they have been generally neglected by collectors
logists. Early writers are also to some extent responsible for
glect, for they failed to discriminate the different species, and
few names, such as *Chætetes lycoperdon*, *Stenopora fibrosa*, etc.,
r a multitude of diverse forms. It is no doubt true, and this
er cause for the neglect of the bryozoa, that their discrimina-
s require good powers of observation and careful, often tedious,
Furthermore, the number of species is appalling. Somewhat
an 1,300 species have been described from American Paleozoic
ons, yet these are probably but a half or a third of the distin-
le forms present. These various considerations compel greater
r the mastery of the bryozoa than for any other class. The
nation—at least the first determination—of a species often, and
the Trepostomata nearly always, requires the preparation of
opic sections, a tedious operation at best. However, when once
s has been thoroughly worked out, it can generally be distin-
externally from associated forms of similar appearance by
nstant differences, which often seem trifling, and yet are doubt-
morphological importance.

ginning only has been made in the work of determining the geo-
al distribution of species and genera and elucidating the many
questions regarding the migration of faunas in the ancient seas,
xtinction or evolution, their reapparition, and like phenomena.

COLLECTION AND STUDY.

ndstone formations bryozoa—and this is true of most other fos-
well—are practically wanting, but there is scarcely a limestone
ion, especially if there be shale alternations, in which they are
ndant. Generally they are calcareous, and in this condition
ily sectioned for microscopic study. Sometimes, however, they
nd silicified. Then the internal structure is to a greater or less

extent obliterated, and they can rarely be successfully sectioned for study. Sometimes their substance has been dissolved away, leaving a perfect mold in the matrix. A gutta-percha impression will then often give a very satisfactory idea of the exterior of the original fossil.

The best specimens are usually obtained from the shales between or just above or below limestone layers. The smaller forms may be obtained free by carefully washing the shales and picking them out from the débris. Some kinds of shales or clay will wash away better if first allowed to become thoroughly dry. Others do better if allowed to soak in water for a longer or a shorter period of time.

Often the surface characters are obscured by the clayey matrix. This may be removed by the use of caustic potash. The deliquescence of small pieces of this substance, which needs to be handled gingerly with unprotected hands, laid upon the fossil loosens the clay, which is then easily brushed off. Some workers accomplish the same result by placing their specimens in a saturated solution of Glauber's salts, which in crystallizing loosens the clay.

MAKING OF SECTIONS.

The preparation of thin sections for microscopic examination is indispensable if one would understand the bryozoa. Directions for making sections of fossil bryozoa, more particularly the Paleozoic, are given in the report of the Geological Survey of Illinois, VIII, 1890, p. 292, and in the Geology of Minnesota, III, 1893, p. 100, and with a few additional notes are here repeated. Some experience and considerable care are required to produce satisfactory sections. In the absence of a lathe or machine for cutting rock sections, the following method will give as good and, with experience, even better results than the lathe.

The materials required are (1) a piece of sandstone, not too gritty, 8 or 10 inches wide, 18 or 20 inches long, and of sufficient thickness to insure stability; (2) a water hone 1 inch thick, a little wider, and 4 or 5 inches long; (3) a block of wood (walnut is the best) 1 inch thick, 2 inches wide, and 4½ inches long. The edges of the upper side of this block should be rounded to fit the hand, while in the lower side a shallow excavation 1$\frac{1}{16}$ by 3½ inches is made to fit the ordinary glass slip. The excavation must be so made that the central portion of the glass slip will bear upon the block, while the ends may have a little play.

The procedure for sectioning specimens large enough to be handled without difficulty is as follows: With a strong pair of "wire nippers" a fragment is pinched from the specimen to be sectioned. This fragment is rubbed upon the sandstone until the surface is perfectly flat. In doing this the greatest care must be exercised to retain or obtain, as the case may be, the desired angle. This surface is

hed upon the hone, and the fragment is ready for mounting. A
of Canada balsam is placed upon the center of a glass slip of the
size, which, for economy's sake, may be cut from ordinary win-
lass, and the smoothed face of the fragment upon it. The slip
heated on a heating stage or over a lamp and the Canada bal-
llowed to boil for a certain time, the length of which must be
d by experience. The thickness of the glass and the amount of
re factors to be considered, but in general it may be stated that
slide of average thickness and a medium amount of gum the
g is complete when the edges of the balsam commence to turn
. The slip is then laid upon a horizontal piece of wood to cool.
it is cold the balsam should be tested. The exact hardness
ed must be intermediate between brittleness and the point where
nger nail can make an impression upon it. If too soft, the slip
be carefully reheated; if too hard, fresh gum and reheating may
, but it is better to remove the fragment, clean it and the slide,
mount. If of the proper hardness, the slip is placed in the exca-
of the block, which has been dipped into water to secure adhesion,
he superfluous material is rubbed away upon the sandstone.
nearly thin enough the slide is taken out of the block and fin-
upon the hone. As the glass slip has become scratched and
lly unsightly during the foregoing process, the section may be
erred to a good slip, mounted, and covered in the usual way for
nent preservation. The slide should be carefully labeled, so
t can always be known from which particular specimen the sec-
as made.

cimens too small to be worked in the manner above described—
example, small forms of Bythopora, Rhombopora, or Streblo-
—may be sectioned in the following way: Place a little balsam
slip and heat it, but only enough to partially harden it. Into
eated balsam place several specimens without any rubbing.
cooling rub down a little carefully; reheat cautiously, and with
p-pointed instrument turn one or more specimens so that the
hed face is against the glass. Now cool and rub down farther.
cautiously reheat, and turn the specimens which have not yet
turned. After cooling rub again until the sections are thin
h for microscopic examination, and finish as before.

se sections must be prepared with a knowledge of certain struc-
features. The zoarium of most bryozoa is composed of two
, an inner, in which the zoœcia are immature, and an outer or
eral, in which the zoœcia are in the mature state, and accessory
es, such as acanthopores and mesopores, are developed. To
e all these features usually three sections are needed, a vertical,
ramose or frondescent forms, a longitudinal parallel with the
transverse, which cuts across the axis, and a tangential, which

is parallel to the surface and close enough to it to show the developed in the peripheral region. Of bifoliate forms two sections are needed, one close to the surface and anothe middle (mesotheca), though often one tangential section m so as to show all the features.

Care must be taken to select specimens that have not su compression. Sections of specimens compressed or oth torted have occasionally given rise to grave errors, as, fo when Waagen and Wentzel, misled by sections of specim Fistuliporidæ with the axial region crushed, believed they evidence of the development of zoœcia from the intermedi chymal (vesicular) tissue.

BIBLIOGRAPHY AND INDEX.

LOGICAL CATALOGUE OF PAPERS CONTAINING DESCRIPTIONS AND ILLUSTRATIONS OF AMERICAN PALEOZOIC BRYOZOA.

in which an asterisk (*) precedes the name of the author are of special importance to the bryozoa.]

1832.

Amos. Geological Text-book for aiding the study of North nerican Geology, edition 2, 1832. 134 pp. Paleontology, 22 ., 5 pls.

ns a brief description of Flustra carbaseoides, n. sp. The name has not o use.

1840.

, Gerard. Organic remains discovered in the strata of Tennes- e. (Fifth Geol. Rep. Tennessee, 1840, pp. 45–76.)

known as "Troost's Catalogue." Two species of bryozoa, Escharia ovato- l reticulata, are in the list, but the descriptions are so inadequate that they ver since been recognized.

1842.

y, Alcide d'. Voyage dans l'Amérique Méridionale. Tome [. Paris, 1842.

work Ceriopora ramosa and Retepora flexuosa are described from the Car- us of Bolivia. These are the only Paleozoic bryozoa made known from merica, so far as we know, but it is doubtful whether the forms can be recog- m the descriptions or figures without material from the typical locality.

David Dale. Regarding human footprints in solid limestone. mer. Jour. Sci. Arts, ser. 1, XLIII, p. 19, fig. 2.)

thor gives a figure of Archimedes, calling it Retepora Archimedes, and states name was given by Leseuer. The latter, however, seems never to have d the name.

em, Lardner. Geology of New York, Part III, comprising e survey of the third geological district. Albany, 1842.

ge 46 a figure is given of the "puff-ball Favosite (Favosites lycopodites)" Trenton. The form can not be identified.

1843.

Castelnau, F. de. Essai sur le Système Silurien de l'Amérique Septentrionale. Paris, 1843, 56 pp., 25 pls.

Contains—

Gorgonia repisteria (Goldfuss), p. 50, pl. xxiv, 3; from Schoharie, New York.
Gorgonia anticorum n. sp., p. 50, pl. xxiv, 1; from Lake Huron.
Gorgonia siluriana n. sp., p. 50; from Lake Huron.
Eschara scalpellum (Murchison), p. 50; from Isles Mantoulines.

The descriptions are so meager that no one has succeeded in identifying any of these forms.

1846.

Dana, James D. Zoophytes. (Wilkes's U. S. Exploring Expedition, VIII, Philadelphia, 1846, 740 pp., 61 plates in atlas.)

This work contains a description of Lonsdale's genus Stenopora and of a new genus Constellaria (p. 537), both being considered corals by the author. The latter was established for a species named Ceriopora constellata on plates of Western Fossils by Van Cleve. The form was later erroneously identified as the Stellipora antheloidea of Hall and became currently known as Constellaria antheloidea, Dana's name Constellaria having replaced Hall's Stellipora.

1847.

* **Hall, James.** Paleontology of New York, Vol. I. Albany, 1847. 338 pp., 98 pls.

About twenty new species of bryozoa from the Trenton and Chazy periods are described in this greatest of early works on American paleontology. The new genera established are Stictopora, Escharopora, and Stellipora. As is usual with the early work on fossil bryozoa, both the descriptions and the figures leave much to be desired. Even to-day several of the species are not satisfactorily recognized, while the number and diversity of distinguishable forms referred to "Chætetes lycoperdon" is distressing to the modern student.

1850.

Orbigny, Alcide d'. Prodrome de Paleontologie, Tome I. Paris, 1850.

In this extensive catalogue the following American paleozoic bryozoa are listed: Ptilodictya cruciformis, Ptilodictya pavonia, Sulcopora fenestrata, Subretepora reticulata, Enallopora perantiqua, Constellaria antheloidea, and the new genus Monticulipora with the species mammulata, ramosa, frondosa, and filiasa. Most of the names are accompanied by quite inadequate descriptive remarks, and the validity of those now recognized depends upon the work of subsequent authors. Sulcopora, Subretepora, and Enallopora are new generic terms founded not upon the fossils themselves, but upon Hall's incorrect descriptions and figures of Stictopora fenestrata, Intricaria reticulata and Gorgonia perantiqua, respectively. Resting, therefore, upon fictitious characters, these names have deservedly failed to gain recognition.

1851.

Hall, James. Description of new or rare species of fossils from the Paleozoic series. (Foster and Whitney's Report on the Geology of the Lake Superior Land District, 1851. Bryozoa, pp. 206–208, pls. xxiv, xxv.)

Among the descriptions occur three of bryozoa: Phænopora multipora, Clathropora flabellata n. sp., and Chaetetes lycoperdon Say.

Hall, James. New Genera of fossil Corals. (Amer. Jour. Sci. Arts, ser. 2, XI, 1851, pp. 398–401.)

The following new genera, which soon appeared more fully described in Paleontology of New York, II, are described for the first time: Helopora, Phænopora, Rhinopora, Callopora, Trematopora, Clathropora, Ceramopora, Lichenalia, Sagenella.

Milne-Edwards, Henri, and **Haime, Jules.** Monographie des Polypiers Fossiles des Terrains Paléozoiques. (Archives du Museum, V, 1851, 502 pp., 20 pls.)

The following bryozoa from America are described: Chætetes filiasa (d'Orbigny), dalii n. sp., ramosus (d'Orbigny), mammulatus (d'Orbigny), frondosus (d'Orbigny), pavonia (d'Orbigny), tuberculatus n. sp., rugosus n. sp., Dekayia n. gen., D. aspera n. sp., Constellaria Dana, C. antheloidea (Hall).

Rolle, Friedrich. Ueber zwei neue devonische Korallen einer neuen Sippe, Reptaria. (Leonhard und Bronn's Neues Jahrbuch, 1851, pp. 810–814, pl. ixB.)

Describes the new genus Reptaria with two species, R. orthoceratum n. sp., from the Eifel of Germany, and R. stolonifera n. sp., from Cazenovia, New York.

1852.

***Hall, James.** Paleontology of New York, Vol. II. Albany, 1852. Bryozoa, pp. 40–52, 144–173, pls. xvii–xix, xl–xlE.

This work gives a full account as then known of the bryozoa of the Clinton and Niagara groups of New York. About forty species are described, which, with few exceptions, are easily identified from the descriptions and figures. The following are characterized as new genera: Helopora, Phænopora, Rhinopora, Callopora, Trematopora, Clathropora, Ceramopora, Lichenalia, Sagenella. Species are also described referred to Chætetes, Stictopora, Retepora, Fenestella, Diamesopora (a new genus whose characterization is reserved for future study), Hornera, Polypora.

1854.

Milne-Edwards, Henri, and **Haime, Jules.** A Monograph of the British fossil Corals. (Publications Palæontographical Society, London, 1854.)

In a footnote on page 265 the authors refer to the genus Monticulipora the following forms, which, in their French work (Monographie des Polypiers Fossiles des Terrains Paleozoiques, pp. 266-279), they had referred to Chætetes: M. filiasa d'Orbigny, C. Dalei Milne-Edwards and Haime, M. ramosa d'Orbigny, M. mammulata d'Orbigny, M. frondosa d'Orbigny, Ptilodictya pavonia d'Orbigny, C. rugosus Milne-Edwards and Haime. They also describe the genera Fistulipora M'Coy and Stenopora Lonsdale.

Shumard, Benjamin F. Description of the species of Carboniferous and Cretaceous fossils collected. (Marcy's Report of the U. S. Exploration of the Red River of Louisiana, 1854, Appendix E, pp. 186–199, 6 pls.)

Archimedipora archimedes (page 175, pl. i, 6) is described.

1857.

* **Hall, James.** Remarks upon the genus Archimedes, or Fenestella, from the Carboniferous limestones of the Mississippi Valley. (Amer. Jour. Sci. Arts, ser. 2, XXIII, pp. 203–204.)

This paper contains a general discussion of characters and relationship of Archimedes and Fenestella.

* **Hall, James.** Observations on the genus Archimedes, or Fenestella, with description of species. (Proc. Amer. Assoc. Adv. Sci., X, 1857, pp. 176–180.)

Archimedes and Lyropora are defined as subgeneric terms under Fenestella, and the following species are described: Fenestella (Archimedes) Owenana, Wortheni, Swallovana, Meekana, laxa, Fenestella (Lyropora) lyra, quincuncialis, subquadrans. Unfortunately no figures accompany the paper.

1858.

Hall, James. Geological Survey of Iowa. Volume I, Part II, Paleontology, 1858. Bryozoa, pp. 651–653, pl. xxii.

Descriptions and good figures are given of Archimedes wortheni, reversa n. sp., Ptylopora prouti n. sp., and a description only of Callopora punctata n. sp.

* **Prout, Hiram A.** Description of new species of Bryozoa from Texas and New Mexico. (Trans. St. Louis Acad. Sci., I, 1858, pp. 228–235.)

Describes the following species from Carboniferous and Permian formations: Fenestella trituberculata, Popeana, corticata, intermedia, variabilis, Shumardii, Norwoodiana, subretiformis, Eschara? concentrica, ? tuberculata. No illustrations were given. Some of these may never be identified.

* **Prout, Hiram A.** First of a series of descriptions of Carboniferous Bryozoa. (Trans. St. Louis Acad. Sci., I, 1858, pp. 235–237, pl. xv.)

Describes Fenestralia n. subg., F. St. Ludovici, Fenestella plumosa, Polypora varsoviensis.

* **Prout, Hiram A.** Second series of descriptions of Bryozoa, from the Paleozoic rocks of the Western States and Territories. (Trans. St. Louis Acad. Sci., I, 1858, pp. 266–273, pls. xv, xvi.)

Contains descriptions of Coscinium Keyserling, C. cyclops Keyserling, cribriformis Prout, Keyserlingi Prout, Polypora Mexicana Prout, Shumardii Prout, intermedia Prout.

Swallow, George C. Fossils of the Permian rocks of Kansas. (Trans. St. Louis Acad. Sci., I, 1858, pp. 178–197.)

Proposes the name Synocladia biserialis for a form which he thinks may be Synocladia virgulacea Phillips, and the name Acanthocladia americana for a form which he thinks may be Acanthocladia anceps ? Schlotheim. Also notes a form which he refers to Phyllopora ehrenbergi Geinitz.

1859.

Billings, E. Fossils of the Chazy Limestone, with descriptions of new species. (Canadian Naturalist and Geologist, IV, 1859, pp. 426–470.)

Contains rather brief descriptions of the monticuliporoids Stenopora adherens and patula.

***Prout, Hiram A.** Third series of descriptions of Bryozoa from the Paleozoic rocks of the Western States and Territories. (Trans. St. Louis Acad. Sci., I, 1859, pp. 443–452, pls. xvii, xviii.)

Contains descriptions of Semicoscinium n. g., S. rhomboideum n. sp., Fenestella hemitrypa n. sp., Limaria Steininger, L. falcata n. sp., Flustra spatulata n. sp., tuberculata n. sp., Septopora n. g., S. Cestriensis n. sp., Polypora tuberculata n. sp., biarmica Keyserling, Fenestella banyana n. sp.

1860.

Hall, James. Descriptions of new species of fossils from the Silurian rocks of Nova Scotia. (Canadian Naturalist and Geologist, V, 1860, pp. 144–159.)

The author notes the occurrence of a variety of Helopora fragilis, which he names var. acadiensis, from the "Arisaig Series."

Milne-Edwards, H. Histoire Naturelle des Coralliaires ou polypes propriement dits. Tome III. Paris, 1860. [Monticuliporoids, pp. 272–284.]

In this work the descriptions are repeated of the American forms described in the joint work of Milne-Edwards and Haime, Monographie des Polypiers Fossiles des Terrains Paleozoiques, 1851.

***Prout, Hiram A.** Fourth series of descriptions of Bryozoa from the Paleozoic rocks of the Western States and Territories. (Trans. St. Louis Acad. Sci., I, 1860, pp. 571–581.)

Contains descriptions, without figures, of Coscinium Wortheni n. sp., elegans n. sp., plumosum n. sp., Michelinia n. sp., saganella n. sp., tuberculatum n. sp., asteria n. sp., escharense, n. sp., Cyclopora n. g., C. fungia n. sp., discoidea n. sp., polymorpha n. sp., Jamesii n. sp., Semicoscinium Eriense n. sp., tuberculatum n. sp., Polypora Halliana n. sp., gracilis n. sp.

Some of these appear again, with figures, in Geological Survey of Illinois, II. Considering the early date at which Prout's work was done, it is of a very high order.

Roemer, Ferdinand. Die Silurische Fauna des westlichen Tennessee. Breslau, 1860. 97 pp., 5 pls.

Two species of bryozoa from the Niagara of Tennessee are described: Thecostegites hemisphæricus n. sp., and Fenestella acuticosta n. sp.

1862.

Billings, E. Paleozoic Fossils. Volume I, 1862. (Geological Survey of Canada.)

Contains descriptions of Arthroclema n. g., and A. pulchella n. sp. (pp. 54–55). The descriptions are very good considering the date.

1863.

Winchell, Alexander. Descriptions of fossils from the yellow sandstones lying beneath the "Burlington limestone" at Burlington, Iowa. (Proc. Acad. Nat. Sci. Philadelphia, 1863, pp. 2–25.)

Describes Trematopora ? vesiculosa n. sp. and Trematopora ? fragilis n. sp.

1865.

Billings, E. Notice of some new genera and species of Paleozoic sils. (Canadian Naturalist, new ser., II, 1865, pp. 425–432.)

Contains a meager description of Stenopora bulbosa, a massy monticuliporoid.

Meek, F. B. and **Worthen, A. H.** Description of new specie Crinoidea, etc., from the Paleozoic rocks of Illinois and s adjoining States. (Proc. Acad. Nat. Sci. Philadelphia, 1865, 155–166.)

Characterize Evactinopora (nov. gen.) radiata n. sp. (p. 165).

1866.

* **Billings, E.** Catalogue of the Silurian fossils of the Island of A costi, with descriptions of some new genera and species. (C logical Survey of Canada, Montreal, 1866. 93 pp.)

Contains descriptions of the following new species: Ptilodictya fragilis, niti canadensis, gladiola, excellens, sulcata, superba, rustica, tenera, arguta, alcy Helopora lineata, formosa, concava, strigosa, nodosa, lineopora, armata, bel striatopora, irregularis, Circe, varipora.

The descriptions give no structural details. Some of the forms it may not be sible to recognize; a few others may prove to be synonyms.

* **Prout, Hiram A.** Descriptions of new species of Bryozoa. (Tr St. Louis Acad. Sci., II, 1866, pp. 410–413.)

The species described are Fenestella nodosa, dilata, bifurcata, Polypora imbri rigida, Retepora hamiltonensis, Ptilodictya (Stictopora) variabilis.

* **Prout, Hiram A.** Descriptions of Polyzoa from the Paleozoic ro (Geological Survey of Illinois, II, 1866, pp. 412–423, pls. xxii.)

Gives descriptions with figures of Coscinium Wortheni, elegans, plumosum, M elinia, saganella, tuberculatum, asteria, Cyclopora, C. fungia, discoidea, polymor Polypora Halliana, gracilis, Hamiltonensis. These had all but the last previo appeared in the Trans. St. Louis Acad. Sci., I, 1860.

* **Rominger, Carl.** Observations on Chætetes and some related g era, in regard to their systematic position, with an appen description of some new species. (Proc. Acad. Nat. Sci. Pl delphia, 1866, pp. 113–123.)

After a general discussion descriptions are given of a number of species, inclu besides the Stellipora antheloidea Hall, Trematopora tubulosa Hall, Ceramo foliacea Hall, the following new species: Chætetes quadratus, decipiens, Callo missouriensis, Fistulipora neglecta, Halli, lunata, helios, stellifera, sulcata, mi acervulosa, spinulifera, Eriensis, utriculus, crassa, elegans, Spergenensis, flabel trifolia, compressa, peculiaris. The descriptions are unaccompanied by figures are usually sufficient for identification—a decided merit in a work of that date.

Winchell, Alexander. A report on the Lower Peninsula of M igan. Ann Harbor, 1866. 97 pp. Paleontology, pp. 83–97.

Brief descriptions of the following bryozoa are included: Fistulipora lab Saffordi, Callopora punctillata, Chætetes Hamiltonensis, microscopica, Fenes eximia, filitexta, Stictopora sulcata.

1867.

itz, Hans Bruno. Carbonformation und Dyas in Nebraska. Verhandlungen der kais. Leopoldino-Carolinischen Deutschen kademie der Naturforscher, XXXIII, 1867, pp. i–xii, 1–91, 5 pls.) lso separate, Dresden, 1866, 4to. Bryozoa, pp. 66–72, pl. v.

author identified Permian forms from Nebraska with forms from the Dyas of e. Meek later showed that the identifications were erroneous.

1868.

son, J. W. Acadian Geology, edition 2. Montreal, 1868. Bryzoa, pp. 287–289.

ains rather meager descriptions of Stenopora exilis n. sp., Chætetes tumidus Edwards and Haime, Fenestella lyelli n. sp.

, F. B., and **Worthen, A. H.** Paleontology of Illinois. (Geogical Survey of Illinois, III, 1868.) Bryozoa, pp. 501–504.

riptions are given of Evactinopora and three species—E. radiata, sexradiata, s, and of Fenestella (Lyropora) retrorsa.

1869.

rd, J. M. Geology of Tennessee. Nashville, 1869.

age 286 the following new species are named: Ptilodictya symmetrica, explinultiramis, ? Libana; the last one is very briefly characterized.

1870.

ek, F. B., and **Worthen, A. H.** Note on the relations of Synoladia King 1849 to the proposed genus Septopora Prout 1858. Proc. Acad. Nat. Sci. Philadelphia, 1870, pp. 15–18.)

1871.

, F. B. Description of new species of invertebrate fossils from he Carboniferous and Devonian rocks of Ohio. (Proc. Acad. at. Sci. Philadelphia, 1871, pp. 57–93.)

ains a description of Ptilodictya (Stictopora) Gilberti.

, F. B. Descriptions of new western Paleozoic fossils mainly rom the Cincinnati group of the Lower Silurian series of Ohio. Proc. Acad. Nat. Sci. Philadelphia, 1871, pp. 308–336.)

ains a description of Ptilodictya (Stictopora) Shafferi.

1872.

, F. B. Paleontological Report. (Hayden's Sixth Ann. Rep. . S. Geol. Sur. of the Territories, 1872, pp. 431–518.)

ains description of Ptilodictya (Stictopora) dictyota.

k, F. B. Report on the Paleontology of Eastern Nebraska, with ome remarks on the Carboniferous rocks of that district. (Hayen's Final Report of the U. S. Geol. Sur. of Nebraska and porons of adjacent Territories. Washington, 1872. 264 pp., 11 pls. art II, Paleontology, pp. 81–264.) Bryozoa, pp. 141–158.

author gives full and critical descriptions and figures of Fenestella sp. (Fen-

estella plebeia (Geinitz), Shumardi Prout, submarginata Meek, Polypora sp. ind
cladia biserialis Swallow, Glauconome trilineata Meek, Rhombopora Meek,
dodendroides Meek, and Fistulipora nodulifera Meek.

1873.

Hall, James, and **Whitfield, R. P.** Descriptions of new spec
fossils from the Devonian of Iowa. (Twenty-third Annual R
New York State Museum Nat. Hist., 1873, pp. 223–239, 5 p

Contains descriptions of Fistulipora occidens n. sp. and Stomatopora ? a
n. sp.

Meek, F. B. Descriptions of invertebrate fossils of the Siluri
Devonian systems. (Paleontology of Ohio, I, 1873, pp.
pls. i–xxii.)

Contains descriptions of Ptilodictya (Stictopora) Shafferi, Gilberti, lichen

1874.

Billings, E. Paleozoic Fossils, Vol. II, Part I, 1874. 144 pp.,
(Memoirs of the Geological Survey of Canada.)

Contains descriptions of two species of bryozoa from the Gaspé limes
Canada, Polypora ? Psyche n. sp., and Ptilodictya tarda n. sp.

***Hall, James.** Descriptions of Bryozoa and Corals of the
Helderberg group. (Twenty-sixth Ann. Rep. New York
Museum Nat. Hist., 1874, pp. 93–115.)

This paper is devoted to the bryozoan fauna of the Lower Helderberg
Descriptions only are given. Figures and fuller descriptions are later given
Paleontology of New York, VI. Thirty-four new species are described, refe
the genera Fenestella, Polypora, Hemitrypa, Ichthyorachis, Escharopora, Ca
Trematopora, Ceramopora, Chætetes, and Paleschara, the last a new genus
systematic position is still somewhat doubtful.

***Miller, S. A.** Observations upon Stenopora fibrosa and the
Chætetes. (Cincinnati Quarterly Journal of Science, I,
pp. 368–375.)

After a general discussion the writer gives descriptions of Stenopora Lo
Stenopora fibrosa Goldfuss 1826 from Lexington, Kentucky, Stenopora lyc
Say, Chætetes Fischer, Chætetes petropolitanus (Pander). These are all in
identifications.

***Nicholson, H. Alleyne.** Summary of recent researches o
Paleontology of the Province of Ontario, with brief descri
of some new genera. (Canadian Journal, new ser., XIV,
pp. 125–136.)

The new genera Cryptopora, Carinopora, Tæniopora, and Botryllopo
described.

***Nicholson, H. Alleyne.** Descriptions of two new genera and s
of Polyzoa from the Devonian rocks. (Ann. Mag. Nat.
ser. 4, XIII, 1874, pp. 77–85.)

The author describes Cryptopora n. g. with the new species C. mirabilis an
nopora n. g. with the species Hindei n. sp. Both genera have proved unt
being founded upon imperfect material in a peculiar state of preservation.

Nicholson, H. Alleyne. Descriptions of new fossils from the Devonian formation of Canada West. (Geol. Mag. new ser., I, 1874, pp. 10–16, 54–60, 117–126, 159–163, 197–201, pls. ii, iv, vi, ix.)

This series of papers contains the descriptions of a large number of Corniferous and Hamilton fossils, including bryozoa, which are incorporated in the author's Report on the Paleontology of the Province of Ontario, 1874.

* **Nicholson, H. Alleyne.** Descriptions of species of Chætetes from the Lower Silurian rocks of North America. (Quar. Jour. Geol. Soc. London, XXX, 1874, pp. 499–515, pls. xxix, xxx.)

The author gives a description of Stenopora Lonsdale and nineteen species of Monticuliporoids mainly from the Cincinnati group of Ohio, all of which he refers to the genus Chætetes. These are all redescribed in the Paleontology of Ohio, vol. II, which made its appearance in the following year.

* **Nicholson, H. Alleyne.** Report upon the Paleontology of the Province of Ontario, Toronto, 1874. 133 pp., 8 pls.

The author describes the following genera with from one to four species under each: Aulopora (= Hederella), Chætetes, Callopora, Fistulipora, Botryllopora, Ptilodictya, Polypora, Retepora, Cryptopora, and Fenestella.

* **Nicholson, H. Alleyne,** and **Hinde, George Jennings.** Notes on the fossils of the Clinton, Niagara, and Guelph formations of Ontario, with descriptions of new species. (Canadian Journal, new ser., XIV, 1874, pp. 137–144.)

Descriptions are given of species referred to Chætetes, Helopora, Rhinopora, Phænopora, Ptilodictya, Clathropora. The work is, in the main, repeated in the Report upon the Paleontology of the Province of Ontario, 1875.

White, Charles A. Preliminary report upon invertebrate fossils with descriptions of new species. (Wheeler's Geographical and Geological Exploration and Survey west of the 100th meridian.) Washington, 1874. 27 pp.

Contains descriptions of Glauconome nereidis sp. nov. and Polypora stragula sp. nov.

1875.

Hall, James, and **Whitfield, R. P.** Descriptions of invertebrate fossils mainly from the Silurian system. (Paleontology of Ohio, II, 1875, pp. 67–161, pls. i–ix.)

Several bryozoa from the Clinton of Ohio are described: Retepora angulata? Hall, Rhinopora frondosa n. sp., Stictopora magna n. sp., Clathropora clintonensis n. sp., Phænopora (Ptilodictya) expansa.

* **James, U. P.** Catalogue of Lower Silurian fossils at Cincinnati, Ohio, and vicinity, with descriptions of some new species of corals and polyzoa. Cincinnati, 1875. 8 pp.

The introduction to the catalogue proper contains descriptions of the following new species from the Cincinnati group: Chætetes? calycula, clavacoideus, Cincinnatiensis, ? O'Nealli, Ceramopora Nicholsoni, Ptilodictya acuminata, Alecto nexilis.

Meek, F. B. A report on some of the invertebrate fossils of the Waverly group and Coal Measures of Ohio. (Paleontology of Ohio, II, 1875, pp. 269–347, pls. x, xiv–xx.)

Contains descriptions of Fenestella delicata Meek, multiporata? var. Lodiensis Meek, Synocladia biserialis Swallow, Ptilodictya (Stictopora) serrata Meek, Ptilo (Stictopora) carbonaria Meek.

Meek, F. B., and **Worthen, A. H.** Paleontology of Illinois. Des tions of invertebrates. (Geological Survey of Illinois, VI, pp. 491–532, pls. xxiii–xxxii.)

Contains description of one bryozoan, Chætetes ? carbonaria Worthen.

Miller, S. A. Some new species of fossils from the Cincinnati g and remarks upon some described forms. (Cincinnati Quar Journal Science, II, 1875, pp. 349–355.)

The writer gives descriptions of Calamopora fibrosa Goldfuss and Monticu dalei Milne-Edwards and Haime, the latter in reality Monticulipora ramosa d'Or

* **Nicholson, H. Alleyne.** Report upon the Paleontology of the ince of Ontario, Toronto, 1875. 96 pp., 4 pls.

Some thirty-two species of bryozoa are described, only part for the first mainly from the Trenton, Hudson River (Cincinnati), Clinton and Niagara f tions, referred to the genera Chætetes, Ptilodictya, Retepora, Helopora, Rhin Phænopora, Clathropora, Callopora, Ceramopora; also the new genus Hetero with one new species, H. gigantea.

* **Nicholson, H. Alleyne.** Descriptions of species of Hippotho Alecto from the Lower Silurian rocks of Ohio, with a descri of Aulopora arachnoidea Hall. (Ann. Mag. Nat. Hist., ser. 4, 1875, pp. 123–127, pl. xi.)

Describes from the Cincinnati group of Ohio Hippothoa inflata (Hall), auloporoides n. sp., frondosa James, confusa n. sp., Aulopora arachnoidea Ha

* **Nicholson, H. Alleyne.** Descriptions of new species of Po from the Lower and Upper Silurian rocks of North Am (Ann. Mag. Nat. Hist., ser. 4, XV, 1875, pp. 177–184, pl. x

Describes from the Cincinnati group Ptilodictya falciformis n. sp., emacerata flagellum n. sp., ? arctipora n. sp., fenestelliformis n. sp., Ceramopora ohioensis and from the Niagara Fenestella nervata n. sp.

* **Nicholson, H. Alleyne.** Descriptions of new species and of a genus of Polyzoa from the Paleozoic rocks of North Am (Geol. Mag., new ser., II, 1875, pp. 33–38, pl. ii.)

Describes Heterodictya and H. gigantea, Ptilodictya cosciniformis, Fen Davidsoni, Ceramopora Huronensis, Retepora Trentonensis. These are al scribed in the Report upon the Paleontology of Ontario, 1875.

***Nicholson, H. Alleyne.** On some of the massive forms of Chæ from the Lower Silurian. (Geol. Mag., new ser., II, 1875 175–177.)

Describes Chætetes petropolitanus Pander and Chætetes undulatus Nicholso

***Nicholson, H. Alleyne.** Description of the corals of the Sil and Devonian systems. (Paleontology of Ohio, II, 1875, 181–242, pls. xxi, xxii.)

This paper contains descriptions of twenty-five species of Chætetes, two of C laria and Aulopora arachnoidea Hall.

icholson, H. Alleyne. Descriptions of Polyzoa from the Silurian formation. (Paleontology of Ohio, II, 1875, pp. 257–268, pl. xxv.)

his article contains the descriptions which appeared earlier in the year in the two ers in the Annals and Magazine of Natural History.

1876.

all, James. The fauna of the Niagara group in central Indiana. (Twenty-eighth Ann. Rep. New York State Museum Nat. Hist., 1876 (Documentary edition), 32 plates, with explanation sheets.)

he plates only of this article made their appearance in the Documentary edition he Twenty-eighth Museum Report. The complete edition (Museum edition) did appear until 1879. The article is devoted to descriptions of a large number of cies obtained from the now famous locality on Conns Creek near Waldron, Indiana. enty species of bryozoa are described (Museum edition) and figured. They are rred to the genera Chætetes, Trematopora, Callopora, Lichenalia, Sagenella, amopora, Paleschara, Stictopora, Fenestella, Thamniscus.

ll, James. Paleontology of New York. Illustrations of Devonian fossils.

his work consisted only of plates designed for the Paleontology of New York. It uestionable whether this can be considered a publication, as but a limited number opies were sent out. Chætetes furcatus, tenuis, humilis, tabulatus, and fruticosus the new species of bryozoa incompletely figured in this work (pls. xxxvii, viii).

cholson, H. Alleyne. On the mode of growth and increase amongst the corals of the Paleozoic period. (Trans. Royal Soc. Edinburgh, XXVII, pp. 237–250, 1876.)

general discussion involving some monticuliporoid forms.

icholson, H. Alleyne. Notes on the Paleozoic corals of the State of Ohio. (Ann. Mag. Nat. Hist., ser. 4, XVIII, 1876, pp. 85–94, pl. v.)

his paper marks the opening of a new epoch in the study of Paleozoic bryozoa. the first time, so far as we are aware, the appearances presented by thin sections ved under the microscope form the subject of study and illustration. The species ose internal structure is described, and in most cases figured, are Chætetes rhomus, sigillarioides, nodulosus, rugosus, ramosus, petropolitanus, discoideus, Newyi, Jamesi, gracilis, Fletcheri, tuberculatus, clathratulus, frondosus, Constellaria neloidea, Dekayia attrita.

hite, C. A. Descriptions of new species of fossils from the Paleozoic rocks of Iowa. (Proc. Acad. Nat. Sci. Philadelphia, 1876, pp. 27–34.)

escribes Chætetes muscatinensis n. sp. and Monticulipora monticula n. sp.

1877.

ller, S. A. American Paleozoic fossils; a catalogue of the genera and species. Cincinnati, 1877. xv, 246 pp. Supplement 1883, pp. 247–334. Bryozoa, pp. 95–102, 289–294.

* **Nicholson, H. Alleyne**, and **Etheridge, Robert, Jun.** On Ascodictyon, a new provisional and anomalous genus of Paleozoic fossils. (Ann. Mag. Nat. Hist., ser. 4, XIX, 1877, pp. 463–8, pl. xix.)

The authors characterize very fully the new genus Ascodictyon and describe three species, two from the Hamilton of Ontario and one from the Lower Carboniferous of Scotland, and then discuss at some length the systematic position of the genus.

White, C. A. Report upon the invertebrate fossils collected in portions of Nevada, Utah, Colorado, New Mexico, and Arizona by parties of the expeditions of 1871–1874. (Wheeler's Exploration and Survey west of the 100th Meridian, IV, 1877.) Bryozoa, pp. 99–109, pls. vi, vii.

Describes Rhombopora lepidodendroides Meek, Glauconome nereidis White, Synocladia biserialis Swallow, Polypora stragula White, Monticulipora Dalii Milne-Edwards and Haime (p. 67).

* **James, U. P.** The Paleontologist, Cincinnati, 1878–1883. No. 1, July 2, 1878, pp. 1–8; No. 2, Sept. 14, 1878, pp. 9–16; No. 3, Jan. 15, 1879, pp. 17–24; No. 4, July 10, 1879, pp. 25–32; No. 5, June 10, 1881, pp. 33–44; No. 6, Sept. 12, 1882, pp. 45–56; No. 7, Apr. 16, 1883, pp. 57–59, pls. i, ii.

In this small brochure, appearing at irregular intervals, a large number of new species are described, mainly from the Cincinnati group. Some writers have considered that this work should be disregarded on account of its obscure mode of publication. Inasmuch, however, as it has received some recognition, we have deemed it best to recognize the work and regard as valid such of the species as can be identified from the descriptions. The two plates included in the last number are of no value for identifying the species.

Mickleborough, John, and **Wetherby, A. G.** A classified list of Lower Silurian fossils of the Cincinnati group. (Jour. Cincinnati Soc. Nat. Hist, I, 1878, pp. 61–86.)

Miller, S. A. Description of a new genus and eleven new species of fossils. (Jour. Cincinnati Soc. Nat Hist., I, 1878, pp. 100–108, pl. iii.)

Describes Ptilodictya magnifica n. sp.

Miller, S. A., and **Dyer, C. B.** Contributions to Paleontology. (Jour. Cincinnati Soc. Nat. Hist., I, 1878, pp. 24–39, pls. i, ii.)

The authors describe Monticulipora calceolus n. sp.

* **Miller, S. A.**, and **Dyer, C. B.** Contributions to Paleontology, No. 2. Cincinnati, 1878. 11 pp., 2 pls. (Published by the authors.)

The authors describe the new bryozoan genus Bythopora, with the type species B. fruticosa n. sp.; also Ptilodictya internodia n. sp., and Intricaria clathrata n. sp.

Ulrich, E. O. Descriptions of some new species of fossils from the Cincinnati group. (Jour. Cincinnati Soc. Nat. Hist., I, 1878, pp. 92–100, pl. iv.)

Describes Callopora cincinnatiensis n. sp., Chætetes venustus n. sp., Ptilodictya perelegans n. sp.

C. A. Descriptions of new species of invertebrate fossils m the Carboniferous and Upper Silurian rocks of Illinois and liana. (Proc. Acad. Nat. Sci. Philadelphia, 1878, pp. 29–37.)

bes Ptilodictya triangulata n. sp.

field, R. P. Preliminary descriptions of new species of fossils m the lower geological formations of Wisconsin. (Annual ort of the Geological Survey of Wisconsin for 1877, 1878, pp. -89.)

ıthor describes the following new species, which are afterwards described ed in Geological Survey Wisconsin, IV, 1882: Trematopora annulifer, granu- estella granulosa, Fistulipora solidissima, lens, Chætetes fusiformis, Monti- rectangularis, punctata, multituberculata, Alveolites irregularis.

1879.

James. Descriptions of new species of fossils from the gara formation at Waldron, Indiana. (Trans. Albany Insti- e, X, 1883, pp. 57–76.) Extract distributed 1879.

paper the author describes fifteen additional new species of bryozoa from d Waldron locality. These species have not been illustrated. A few will prove synonyms, while some others can not be recognized from the ons.

James. The fauna of the Niagara group in central Indiana. venty-eighth Ann. Rep. New York State Museum Nat. Hist., iseum edition, 1879, pp. 99–203, 32 pls.) Bryozoa, pp. 110–126, . v–xii.

lson, H. Alleyne. On the structure and affinities of the 'abulate Corals" of the Paleozoic period, with critical descrip- ns of illustrative species. Edinburgh, 1879. 342 pp., 15 pls. yozoa, pp. 253–327, pls. xii–xv.

the Tabulate Corals the author includes the monticuliporoids and their 'he following genera of bryozoa are characterized and critically discussed: ipora, Heterotrypa, Dekayia, Constellaria, Fistulipora, Diplotrypa, Mono- asopora. One or more typical species of each are described and their inter- ture elucidated.

h, E. O. Descriptions of new genera and species of fossils m the Lower Silurian about Cincinnati. (Jour. Cincinnati Soc. t. Hist., II, 1879, pp. 9–30, pl. vii.)

ew genera, Rhopalonaria and Crateripora, and five new species are described, aaria venosa, Chætetes compressus, Fistulipora flabellata, Crateripora lineata expansa, Crateripora erecta.

h, E. O. Description of a new genus and some new species of yozoans from the Cincinnati group. (Jour. Cincinnati Soc. t. Hist., II, 1879, pp. 119–131, pl. xii.)

bes the new genus Atactopora with seven new species, A. hirsuta, maculata, nosa, mundula, tenella, subramosa, septosa; also Stellipora limitaris and granuliferus, irregularis, subglobosus, elegans.

tt, C. D. Fossils of the Utica slate. (Trans. Albany Institute, 1883, pp. 18–38.) Extract distributed 1879.

bes Sagenella ambigua n. sp. from the Utica slate.

White, C. A. Paleontological Papers No. 11: Remarks upo Carboniferous fossils from Colorado, Arizona, Idah Wyoming, and certain Cretaceous corals from Colorado, with descriptions of new forms. (Bulletin U. S. G Survey, V, 1879, pp. 209–221.)

This paper contains a description of Ptilodictya triangulata White.

1880.

***Hall, James.** Corals and Bryozoans of the Lower Helderbe (Thirty-second Ann. Rep. New York State Museum N Albany, 1879, pp. 141–176, pls. vii–xxii.)

This work is a continuation of the work on the bryozoan fauna of the I derberg group published in 1874. Seventy-four species are described a most of them new, referred to the genera Chætetes, Trematopora, Callopo alia, Ceramopora, Paleschara, Stictopora, Escharopora, Fenestella, Icht and Thamniscus.

Miller, S. A. Description of four new species of Siluria (Jour. Cincinnati Soc. Nat. Hist., III, 1880, pp. 140–14

Describes Bythopora nashvillensis n. sp.

Ulrich, E. O. Catalogue of fossils occurring in the Cincinn of Ohio, Indiana, and Kentucky. Cincinnati, 1880. iv,

Whitfield, R. P. Descriptions of new species of fossils Paleozoic formations of Wisconsin. (Ann. Rep. Wisco logical Survey for 1879, 1880, pp. 45–71.)

Contains description of one new species of bryozoa, Fistulipora rugosa.

1881.

Claypole, E. W. On the occurrence of an archimediform Fe in the Upper Silurian rocks of Ohio. (Proceedings of th can Association for the Advancement of Science, XX p. 191.)

The author notes the occurrence of this remarkable form for which h the new genus and species Helicopora latispiralis.

***Hall, James.** Bryozoans of the Upper Helderberg and groups. (Trans. Albany Institute, X, 1883, pp. 145–19 tributed in the form of extracts separately paged in 1881

This paper contains brief, usually inadequate descriptions, without illus 189 new species from the Upper Helderberg of New York and Ontario, an Falls of the Ohio, which deposit Hall considered of Upper Helderberg age the Hamilton group of New York, Ontario, and elsewhere. Most of th were later more fully described and figured in the Paleontology of New 1887. The new genera and subgenera proposed are Phractopora, Th Intrapora, Thamnopora, Prismopora, Scalaripora, Cystopora, Clonopora, Semiopora, Acrogenia, Hederella, Ptilionella, and Hernodia.

Miller, S. A. Subcarboniferous fossils from the Lake Valle district of New Mexico, with descriptions of new species. Cincinnati Soc. Nat. Hist., IV, 1881, pp. 306–315, pl. vii

Describes Trematopora americana n. sp.

olson, H. Alleyne. On the structure and affinities of the genus Ionticulipora and its subgenera, with critical descriptions of illus-rative species. Edinburgh, 1881. 240 pp., 6 pls. A review of is work appeared in the Ann. Mag. Nat. Hist., ser. 5, VIII, 1881, p. 61–63.

memoir is an expansion of the latter part of the author's work "On the re and Affinities of the Paleozoic Tabulate Corals." After chapters on the l History of the Genus Monticulipora, Its General and Comparative Structure, pment, Affinities and Zoological Position, Relations to Other Genera and Sub-ns, full and careful descriptions are given of the genera and subgenera (as the calls some of them) Fistulipora, Constellaria, Dekayia, Monticulipora, Diplo-Monotrypa, Prasopora, Peronopora, Heterotrypa, with illustrative species fully curately described and amply figured. This memoir marks a very great e over any previous work.

stedt, Friedrich Augustus. Die Roehren- und Sternkorallen. Petrefactenkunde Deutschlands, VI.) Leipzig, 1881. Plates in tlas.

is work, a general review of corals and some bryozoa, are references with more extended descriptive remarks to a number of American species, accompanied good figures in the atlas. Chætetes frondosus var. limatus, Chætetes levi-and Fenestella incongruens are new names proposed for American forms. The d third are inadequately described; the second is a synonym for Bythopora (Nicholson).

1882.

Ira M. The corals of Delafield. (Transactions of the Wiscon-n Academy of Science, V, 1882, pp. 185–193.)

paper is a general discussion more particularly of the monticuliporoid forms ng at this noted locality and described in the Geology of Wisconsin, IV.

, James. Descriptions of species of fossils found in the Niagara roup at Waldron, Indiana. (Indiana, Department of Geology nd Nat. Hist., Eleventh Ann. Rep., 1882, pp. 217–345, pls. iv–xi.)

is a reproduction for the benefit of Indiana readers of Hall's papers on the n fossils, which appeared in the Twenty-eighth Ann. Rep. New York State n, 1876–1879, and the Trans. Albany Institute, X, Extract, 1879.

er, S. A. Notice of a work by Prof. Nicholson on the Genus Ionticulipora. (Jour. Cincinnati Soc. Nat. Hist., V, 1882, pp. 5–33.)

conoclastic review of Prof. Nicholson's "Genus Monticulipora."

r, S. A. Description of two new genera and eight new species f fossils from the Hudson River group, with remarks upon others. Jour. Cincinnati Soc. Nat. Hist., V, 1882, pp. 34–44, pls. i, ii.)

ribes Stomatopora proutana n. sp.

ch, E. O. American Paleozoic bryozoa. (Jour. Cincinnati Soc. at. Hist., V, 1882, pp. 121–175, pls. vi–viii, pp. 232–257, pls. x, i; VI, 1883, pp. 82–92, pl. i, pp. 148–168, pls. vi, vii, pp. 245–79, pls. xii–xiv; VII, 1884, pp. 24–51, pls. i–iii.)

is the first attempt at a comprehensive account of the bryozoa found in Ameri-eozoic strata. After a general discussion regarding the affinities and system-sition of some groups of bryozoa (Trepostomata), whose systematic position had been a bone of contention for many years, the author gives brief di most of the Paleozoic genera hitherto known and proposes the new genera I Leioclema, Scenellopora, Mitoclema, Arthronema, Graptodictya, Arthropo nopora, Stictoporella, Rhinidictya, Cystodictya, Pachydictya, Phyllodictya, pora, Batostomella, Calloporella, Aspidopora, Dekayella, Petigopora, Discot tiopora, Didymopora, Ceramoporella, Cheiloporella, Crepipora. Then are a large number of new species (81). The descriptions are full and accur parisons with related species and often critical notes are given. A new sub Trepostomata, is founded.

White, C. A. Van Cleve's fossil corals. (Indiana, Depart Geology and Nat. Hist., Eleventh Ann. Rep., 1882, pp. pls. xliv–lv.)

Contains descriptions of Constellaria antheloidea Hall, Monticulipora d'Orbigny, and Clathropora frondosa Hall.

* **Whitfield, R. P.** Paleontology. (Geology of Wisconsin, I pp. 163–349, pls. i–xxvii.)

Contains descriptions of the following species: Chætetes fusiformis, Mon rectangularis, punctata, multituberculata, ? Ortoni, Alveolites irregularis, granulosa, Stictopora fragilis, Trematopora granulata, annulifera, Fistulipo sima, rugosa, lens, Constellaria polystomella.

Whitfield, R. P. Descriptions of new species of fossils fro (Annals New York Acad. Sci., II, 1882, pp. 193–244.)

Describes Synocladia rectistyla.

1883.

* **Claypole, E. W.** On Helicopora, a new spiral genus (wi species) of North American Fenestellids. (Quar. Jour. G London, XXXIX, 1883, pp. 30–38, pl. iv.)

Gives a description of Helicopora n. gen. with three new species—H. la Ulrichii, and archimediformis, and a brief discussion of the family Fenest which the new genus is referred by the author.

* **Foord, A. H.** Contributions to the micro-paleontology Cambro-Silurian rocks of Canada. (Geol. Nat. Hist. Surv ada, Ottawa, 1883. 26 pp., 7 pls.)

The writer gives a good account of monticuliporoids from Ordovician stra ada. The species were studied according to modern methods and the internal structure are well described and figured. The new species are I pora Westoni, Billingsi, Homotrypa similis, Prasopora oculata, affinis, D regularis, Amplexopora superba, Canadensis, Batostoma Ottawaense, S areolata.

Hall, James. Van Cleve's fossil corals. (Indiana, Departme ogy and Nat. Hist., Twelfth Ann. Rep., 1883, pp. 239– i–xiv.)

In this volume are reproduced a number of plates of western fossils, d engraved by John W. Van Cleve previous to 1853. The publication of the prevented by the author's death. The bryozoa, derived from the Cinci Clinton groups, are identified by Professor Hall. The new species are P bipunctata, Stictopora compressa, bifurcata, and Van Clevii.

* **Hall, James.** Discussion upon the manner of growth, variation of form, and characters of the genus Fenestella, and its relations to Hemitrypa, Polypora, Retepora, Cryptopora, etc. (Report of the State Geologist of New York for the year 1882, Albany, 1883, pp. 5–16, 36 figs.)

Contains a discussion of Fenestella and related genera, and 25 plates prepared for, and later appearing in, Paleontology of New York, VI, 1887.

* **Hall, James.** Fossil corals and bryozoans of the Upper Helderberg group. 25 plates with explanation sheets. (Report of the State Geologist of New York for the year 1882, Albany, 1883, pls. vii–xxxiii.)

James, U. P. Descriptions of fossils from the Cincinnati group. (Jour. Cincinnati Soc. Nat. Hist., VI, 1883, pp. 235–236, pl. x.)

Contains description of Monticulipora dychei n. sp.

White, C. A. Contributions to invertebrate paleontology, No. 6: certain Carboniferous fossils from the Western States and Territories. (Hayden's Twelfth Ann. Rep. U. S. Geogr. Geol. Surv. of the Territories, Part I, 1883, pp. 119–141, pls. xxxiii–xxxvi.)

Contains description and figures of Ptilodictya triangulata.

1884.

* **Foord, Arthur H.** On three new species of Monticuliporoid Corals. (Ann. Mag. Nat. Hist., ser. 5, XIII, 1884, pp. 338–342, pl. xii.)

Describes Monotrypa macropora and Amplexopora microtoma from the Wenlock of England, and Dekayella robusta from Cincinnati, Ohio.

* **Hall, James.** Descriptions of the Bryozoans of the Hamilton group. (Report of the State Geologist of New York for the year 1883, Albany, 1884, pp. 5–61.)

Contains descriptions of 74 species of bryozoa, all of which afterwards reappeared in Paleontology of New York, VI, 1887.

* **Hall, James.** Bryozoa (Fenestellidæ) of the Hamilton group. (Thirty-sixth Ann. Rep. New York State Museum Nat. Hist., Albany, 1883, pp. 57–72.)

Contains descriptions of 20 species of Fenestella, which afterwards reappeared in Paleontology of New York, VI, 1887.

* **James, U. P.** Descriptions of three species of fossils. (Jour. Cincinnati Soc. Nat. Hist., VII, 1884, pp. 21–24.)

Describes Fistulipora oweni sp. nov. and Ceramopora ? beani James, both species illustrated with woodcuts.

* **James, U. P.** Descriptions of four new species of fossils from the Cincinnati group. (Jour. Cincinnati Soc. Nat. Hist., VII, 1884, pp. 137–139, pl. vii.)

Describes Monticulipora ohioensis n. sp. and falesi n. sp.

Ringueberg, Eugene N. S. New fossils from the four groups of the Niagara period of western New York. (Proc. Acad. Nat. Sci. Philadelphia, 1884, pp. 144–150, pls. ii, iii.)

Describes Stictopora obliqua n. sp. and graminifolia n. sp. Descriptions and figures are both worthless.

Spencer, J. W. Niagara fossils. Part III. Fifteen new species Niagara fossils. (Trans. St. Louis Acad. Sci., IV, 1884, pp. 6(610, pls. vii–ix.) Also in (Bulletin of the Museum of the Univ sity of the State of Missouri, I, No. 1, 1884, pp. 52–61, pls. vii–i

Describes Rhinopora venosa n. sp., Clathropora? gracilis n. sp., Fenestella bico n. sp., Polypora (Fenestella?) Albionensis n. sp. The fossils themselves are v poorly preserved, the descriptions given are inadequate, and the illustrations almost worthless. It is doubtful if any can be recognized. The first two are alm certainly synonyms for other species.

1885.

Davis, William J. Kentucky fossil Corals. Part II, 1885. (Kentuc Geological Survey, John R. Proctor, director.) 139 pls., no te

Of this work only the plates have appeared. In the explanation sheets of pl 51, 73, 78, and 80 occurs a new generic term, Nicholsonia, with three species—ca densis (= Hederella canadensis (Nicholson)), adnata, and angulata. The last is a bryozoan nor even a fossil, while the second, though too poorly figured to determined with certainty, is probably the same as Hederalla filiformis (Billings

***Hall, James.** On the mode of growth and relations of the Fenestellic (Report of the State Geologist of New York for the year 18 Albany, 1885, pp. 35–46, pls. i, ii.)

The author defines various genera referred to the Fenestellidæ and gives two pl to illustrate generic structure. The work was in large part later incorporated in Paleontology of New York, VI, 1887. New genera, mostly called subgenera by author, are Fenestrellina [d'Orbigny?], Fenestropora, Ptyloporina, Ptylopor Unitrypa, Isotrypa.

***Nicholson, H. Alleyne, and Foord, Arthur H.** On the genus Fis lipora M'Coy, with descriptions of several species. (Ann. M Nat. Hist., ser. 5, XVI, 1885, pp. 496–517, pls. xv–xviii.)

An admirable study of the genus Fistulipora and a number of its species. ' structure of a number of previously recorded species is well worked out and the lowing new species fully described: Fistulipora muscosa (Lower Carbonifero Scotland), nummilina (Wenlock—England), dobunica (Wenlock—England), co vica (Wenlock—England). American species described are F. utriculus Romin eriensis Rominger.

1886.

***Hall, James.** Bryozoa of the Upper Helderberg group. Plates a explanations. (Fifth Ann. Rep. State Geologist, New York, the year 1885, Albany, 1886, 14 pls.) Twelve plates bound quarto form were sent out in 1886 under the above title in broch form.

These plates appeared subsequently in the Paleontology of New York, VI, 188

Ringueberg, Eugene N. S. New genera and species of fossils from Niagara shales. (Bulletin Buffalo Soc. Nat. Sci., V, 1886, pp. 22, pls. i, ii.)

Describes the following new species: Ceramopora orbiculata, Rhinopora curv Stomatopora recta, parva, Chætetes expansus. The illustrations are very poor.

h, E. O. Descriptions of new Silurian and Devonian fossils.
ontributions to American Paleontology, Volume I, No. 1, Cin-
nati, 1886, pp. 3–35, pls. i–iii.) Bryozoa, pp. 3–25, pls. i, ii.
ublication, designed as a serial, ended with its first number. The author
critically the families Fenestellidæ and Acanthocladiidæ and diagnoses their
Two new genera are defined, Buskopora and Lichenotrypa, and sixteen new
om the Falls of the Ohio, referred to the genera Fenestella, Semicoscinium,
, Polypora, Fistulipora, Eridopora, Buskopora, Lichenotrypa, and Discotrypa.

h, E. O. Report on the Lower Silurian Bryozoa, with prelimi-
y descriptions of some of the new species. (Fourteenth Ann.
p. Geol. Nat. Hist. Sur. Minnesota, 1886, pp. 57–103.)
w genus is established, Homotrypella, and 37 new species described from
ton strata of Minnesota, which are later fully described and figured in
of Minnesota, III.

1887.

ste, August F. Flint Ridge Bryozoa. (Bulletin of the Scien-
c Laboratories of the Denison University, II, 1887, pp. 71–88,
vii.)
per, following the lines of work laid down by Mr. Ulrich, deals fairly well
Coal Measures fauna of Flint Ridge in central Ohio. One new genus,
ctyon, is proposed, and the following new species are described: Rhombo-
tipora, Glauconome whitii, Chainodictyon laxum, Fenestella limbatus and
otus, Stenopora Ohioensis.

ste, August F. The Clinton group of Ohio, Part III. (Bulle-
of the Scientific Laboratories of the Denison University, II,
7, pp. 149–176, pls. xv–xvii.) [The plates were, however,
itted from this volume, but pls. xv and xvi appear in the suc-
ding volume, III, 1888.]
per contains the best account which has yet appeared of the bryozoan fauna
nton group in Ohio. The new species are Hemitrypa ulrichi, Pachydictya
bifurcata-instabilis, turgida, obesa, Prasopora parmula, Monotrypella con-
llopora magnopora, Ohioensis.

te, August F. Recent methods in the study of the Bryozoa.
ience, X, 1887, pp. 225–226.) Also, Sections of fossils. (Sci-
e, XI, 1888, p. 22.)
wo articles, written in reply to earlier communications in Science by Joseph
decrying the newer methods of investigating Paleozoic bryozoa, set forth
y the spirit and method of modern studies on the Paleozoic bryozoa.

James. Descriptions of Fenestellidæ of the Hamilton group
New York. (Sixth Ann. Rep. State Geologist New York for
year 1886, Albany, 1887, pp. 43–70, pls. i–vii.)
s descriptions of twenty-two species of Fenestella, of which four are called
m the Hamilton group, illustrated by thirteen plates, of which seven appear
port and the remainder in the Forty-first Ann. Rep. New York State Museum
., 1888.

* **Hall, James**, and **Simpson, George B**. Paleontology of New Y VI, Corals and Bryozoa: Text and plates containing descrip and figures of species from the Lower Helderberg, Upper He berg and Hamilton groups. Albany, 1887. xxvi, 298 pp., 6

It is to be regretted that this, the most important work of the New York S upon the bryozoa, should prove on critical examination to be of so little value to the systematist or to the practical paleontologist. As Hall acknowledges th work was practically done by the draftsman, Mr. George B. Simpson, the and demerits of the volume may be properly charged to the latter. The dra however beautiful, are diagrammatic to an extreme and are of little assistance student. The descriptions are in many cases vague, and often differ so decidedl previous descriptions of the same form that no reliance can be placed upon The great number of forms distinguished is confusing. Synonyms, we b abound. (See note under Lioclema minutum in the Catalogue of Genera and S The bryozoa of New York still require study.

Brief generic diagnoses of the genera and subgenera used, 60 in numb given in the preliminary pages, prepared by Mr. Charles E. Beecher. Descr follow of 83 species and 3 named varieties from the Lower Helderberg, 153 and 6 named varieties from the Upper Helderberg (a large number of these ar the Falls of the Ohio and are now considered by Ulrich of Hamilton age), a species from the Hamilton. A few species (one from the Niagara) have cre the plates without description.

* **James, U. P.**, and **James, Joseph F**. On the Monticuliporoid of the Cincinnati group, with a critical revision of the sp (Jour. Cincinnati Soc. Nat. Hist., X, 1887, pp. 118–141; X, pp. 158–184; XI, 1888, pp. 15–47.

The title is sufficiently explanatory of these papers, which are iconoclastic i and decry modern methods of research. A few species described by Mr. U. P. are wretchedly illustrated.

Rominger, Carl. Description of a new form of Bryozoa. (Acad. Nat. Sci. Philadelphia, 1887, p. 11, pl. i.)

Gives a description of the exterior appearance of three specimens of a new zoan discovered in Corniferous drift bowlders of Michigan for which the new and specific name Patellipora stellata is proposed.

1888.

Foerste, August F. Notes on Paleozoic fossils. (Bulletin Sci Laboratories Denison University, III, 1888, pp. 117–136, pl.

This paper contains an additional note on Chainodictyon laxum.

* **Hall, James**. Description of new species of Fenestellidæ c Lower Helderberg, with explanations of plates illustrating s of the Hamilton group, described in the report of the Geologist for 1886. (Report of State Geologist of New Yo the year 1887, pp. [393–4], pls. viii–xv.) This report is with the Forty-first Ann. Rep. New York State Museum Hist., 1888.

Contains descriptions of Fenestella (Tectulipora nov. subgen.) loculata n. Fenestella frequens, and eight plates, the first six illustrating species of Fen described the preceding year in the Sixth Ann. Rep. State Geologist of New

The last two illustrate species of Fenestella, Fistulipora, and Lichenalia described but not figured in Paleontology of New York, VI, 1887.

Herrick, C. L. Geology of Licking County. (Bulletin Denison University, IV, 1888, pp. 11–60, pl. x.)

On the plate the author figures Fenestella albida? and Pinnatopora intermdia Ulrich.

James, Joseph F. Monticulipora, a coral and not a polyzoon. (American Geologist, I, 1888, pp. 386–392.)

Keyes, C. R. On the fauna of the Lower Coal Measures of central Iowa. (Proc. Acad. Nat. Sci. Philadelphia, 1888, pp. 222–246, pl. xii.)

Gives descriptions of Rhombopora lepidodendroides Meek, and Synocladia biserialis Swallow.

* **Ulrich, E. O.** On Sceptropora, a new genus of Bryozoa, with remarks on Helopora, Hall, and other genera of that type. (American Geologist, I, 1888, pp. 228–234.)

In this paper the genera Sceptropora (nov. gen.), Helopora Hall, Arthroclema Billings, and Arthrostylus (proposed for Arthronema, found to be preoccupied) are described and the new species Sceptropora facula and Helopora lindstromi from Gotland.

* **Ulrich, E. O.** A list of the Bryozoa of the Waverly group in Ohio; with descriptions of new species. (Bulletin Denison University, IV, 1888, pp. 62–96, pls. xiii, xiv.)

The paper includes the descriptions of five new and three other species of Fenestella, one new species of Polypora, five new species of Pinnatopora, one new species of Tæniodictya, three of Cystodictya, seven of Streblotrypa, one of Rhombopora.

1889.

Foerste, August F. Notes on Clinton group fossils, with special reference to collections from Indiana, Tennessee, and Georgia. (Proc. Boston Soc. Nat. Hist., XXIV, 1889, pp. 263–355, pls. v–ix.)

The author gives notes on additional species from the Clinton group. Three new species and one new variety of bryozoa are described: Ptilodictya expansa-emarcescens, farctus, famelicus, rudis.

* **Miller, S. A.** North American Geology and Paleontology. Cincinnati, 1889. 664 pp., 1194 figs. in text. Bryozoa, pp. 289–330, figs. 448–531. First Appendix, 1892, pp. 665–718, figs. 1195–1265. Bryozoa, pp. 684–685. Second Appendix, 1897, pp. 719–793. Bryozoa, pp. 755–758.

This ambitious work, a catalogue of the genera and species of North American Paleozoic fossils, the genera diagnosed, must be used with caution. Many of the bryozoa are found classed among the Cœlenterata, and the Bryozoa section is badly mixed.

Nettleroth, Henry. Kentucky fossil shells, 1889. (Kentucky Geological Survey, John R. Procter, Director.) 245 pp., 36 pls.

Descriptions are included in this work of Ptilodictya and Ptilodictya hilli James.

***Ulrich, E. O.** Contributions to the micro-paleontology
Cambro-Silurian rocks of Canada. Part II. Geol. N
Sur. Canada, Montreal, 1889, pp. 27–57, pls. viii, ix.)

The paper contains an account with descriptions of the bryozoa coll
Stony Mountain, Manitoba. One new genus is created, Goniotrypa, and
of new species.

1890.

***Nickles, J. M.** Studies on Monticulipora. (American G
VI, 1890, pp. 396–399.)

A rejoinder to Rominger's Studies on Monticulipora, American Geologis
pp. 102–121.

*** Rominger, Carl.** Studies on Monticulipora. (American G
VI, 1890, pp. 102–121.)

A paper general and critical in nature, and taking strong ground agai
methods of determination.

***Ulrich, E. O.** New Silurian Bryozoa. (Jour. Cincinnati S
Hist., XII, 1890, pp. 173–198, 22 figs. in text.)

Describes the new genera, Vinella and Diastoporina, and new species b
the genera Vinella, Stomatopora, Mitoclema, Diastoporina, Phyllopori
dictya, Pachydictya, Stictoporella, Arthrostylus, Helopora, Arthroclema, N
These afterwards appeared in the Geology of Minnesota, III, 1893.

*** Ulrich, E. O.** Paleozoic Bryozoa. (Geological Survey of
VIII, 1890, pp. 285–688, pls. xxix–lxxviii.)

The publication of this most important memoir marks an epoch in the s
Paleozoic Bryozoa. Based upon an elaborate series of investigations embra
large number of Paleozoic species and a vast amount of material, a clas
proposed laid down along lines which are not likely soon to be distu
"Introduction and terminology" is followed by chapters on the "Genera
parative structure of Paleozoic Bryozoa" and the "Classification and inter
families and genera." The definitions of suborders, families, and genera a
drawn, some 310 species, many of them new, described and figured. T
indispensable to the student of Paleozoic Bryozoa.

1891.

***Hall, James.** Continuation of descriptions of Bryozoa not
Volume VI, Paleontology of New York, for the Repo
State Geologist, 1890. (Tenth Annual Report of the St
ogist of New York for the Year 1890, Albany, 1891, p
Also in Forty-fourth Annual Report of the New Y
Museum, 1891, pp. 67–87.)

Contains descriptions of Hamilton group bryozoa, for which there was
Paleontology of New York, VI. There are described: Paleschara, five spe
pora, nineteen species; Semiopora, one species; Prismopora, two species;
two species; Thamniscus, one species; Hederella, one species; Ptilopora, t
There are no illustrations.

aves, J. F. Contributions to Canadian Paleontology, Vol-
e I, Part III. The fossils of the Devonian rocks of the
ckenzie River Basin. (Geol. Nat. Hist. Sur. Canada, 1891,
. 197–253, pls. xxvii–xxxii.)

ns the following new species: Proboscina laxa, Stomatopora moniliformis,
pella Unjiga.

1892.

Ienry M. Notes and descriptions of some new or hitherto
recorded species of fossils from the Cambro-Silurian (Ordovi-
n) Rocks of the Province of Quebec. (Canadian Record of Sci-
e, V, 1892, pp. 96–103.)

ns descriptions of Dicranopora parva, n. sp.; Prasopora lycoperdon Van-
r. Selwyni, n. var.; Diplotrypa Quebecensis, n. sp.; Monotrypa incerta,
t is doubtful whether any of these, except Diplotrypa Quebecensis, which
been redescribed and figured by Ulrich, will gain recognition.

ger, Carl. On the occurrence of typical Chætetes in the Devo-
n strata at the Falls of the Ohio, and likewise in the analogous
ds of the Eifel in Germany. (American Geologist, X, 1892,
. 56–63, pl. iii.)

eral discussion with figures and some description of Monotrypa tenuis Hall,
ponderosus Rominger, and two species not bryozoans.

1893.

renville, A. J. On Hemitrypa hibernica McCoy. (Scientific
oceedings of the Royal Dublin Society, (n. s.) VIII, 1893, pp.
–144, pl. viii.)

thor gives an admirable account of the history of the genus Hemitrypa,
ructure he apprehends correctly. The article contains numerous references
ican work and American species.

s, Joseph F. Manual of the paleontology of the Cincinnati
oup. (Jour. Cincinnati Soc. Nat. Hist. 1893–1896. Part IV in
l. XV, 1893, pp. 144–159; Part V in Vol. XVI, 1894, pp. 178–
; [Part VI] in Vol. XVIII, 1895, pp. 67–88; [Part VII] in Vol.
VIII, 1896, pp. 115–140.)

ptions are given of the species of monticuliporoids of the Cincinnati group
he author considered valid, and those which he considered synonyms are
to the species of which he considered them synonyms. The work, which is
onoclastic, was left unfinished by the death of the author.

h, E. O. On Lower Silurian Bryozoa of Minnesota (Geology
Minnesota, III, Part I, Minneapolis, 1893, pp. 96–332, pls.
xviii.)

to the memoir in the Geological Survey of Illinois, VIII, 1890, this is the
portant work on the Paleozoic Bryozoa, even though it deals mainly with the
of Minnesota. The classification given in the Illinois work is improved in
rticulars. The descriptive part contains 157 species, many of them new,
to 50 genera.

1894.

*** Keyes, Charles Rollin.** Missouri Geological Survey, V tology of Missouri, Part II, Jefferson City, 1894. 22 pls. Bryozoa, pp. 13–37, pls. xxxiii, xxxiv.

Catalogues with synonymy and localities the species of bryozoa found i of Missouri or near its boundaries. Some species are described and descriptions and figures being mostly reproductions from the Geologica Illinois, VIII, 1890.

1895.

Ami, H. M. Notes on Canadian fossil bryozoa. (Canadian Science, VI, 1895, pp. 222–229.)

Notes the Canadian forms described by E. O. Ulrich in the Geolog sota, III.

Foerste, August F. Fossils of the Clinton group in Ohio anc (Geol. Sur. Ohio, VII, 1895, pp. 516–601, pls. xxviii–xx

In this work there is reproduced with more or less fullness, for the ben readers, what Mr. Foerste had published regarding the Clinton group in vious papers.

Herrick, C. L. Observations upon the so-called Waverly Ohio. (Geol. Sur. Ohio, VII, 1895, pp. 495–515, pl. xi

Rhombopora ohioensis Ulrich is figured on pl. xix.

*** Simpson, George B.** A discussion of the different genera tellidæ. (Thirteenth Ann. Rep. State Geologist New the year 1893, Albany, 1894 [distributed 1895], pp. 687– in Forty-seventh Ann. Rep. New York State Museum N 1894, pp. 881–921.)

A general discussion of the Fenestellidæ and inter-relations of the ge author reproduces original figures by Prout and King of species of Sem Fenestralia, Phyllopora, Synocladia. The following new generic names belliporina, Polyporella, Flabelliporella, Reteporella, Pinnaporina, Pi Cycloporina, Tectuliporella, Lyroporina, Lyroporella.

Whiteaves, J. F. Systematic list, with references, of the the Hudson River or Cincinnati formation at Stony Manitoba. (Paleozoic Fossils, III, Part II, 1895, pp. Geol. Sur. Canada.)

The paper contains no descriptions, but synonymy and localities are gi

Whitfield, R. P. Contributions to the paleontology of Ohic Sur. Ohio, VII, 1895, pp. 407–494, pls. i–xii.)

Contains a description of Synocladia rectistyla.

1896.

Harper, George W., and **Bassler, R. S.** Catalogue of the the Trenton and Cincinnati periods, occurring in the Cincinnati, Ohio. Cincinnati, 1896. 34 pp.

A list of fossils, including bryozoa, showing their vertical range.

James Perrin. Marine fossils from the Coal Measures of kansas. (Proc. American Phil. Soc., XXXV, 1896, pp. 213– , pls. xvi–xxiv.)

the occurrence of several Coal Measures bryozoa at Poteau Mountain, rritory, and in northeastern Arkansas.

, E. O. Bryozoa. (Zittel's Text-book of Paleontology (English ion). Translated and edited by Charles R. Eastman. Vol. art I.) Bryozoa, pp. 257–291, figs. 411–488.

ork gives a comprehensive survey and classification of all the bryozoa. rders are recognized: Ctenostomata, Cyclostomata, Cryptostomata, Treposto- Chilostomata. One new genus is defined, Cyclotrypa.

1897.

on, George B.

dbook of the genera of the North American Paleozoic Bryozoa. introduction upon the structure of living species. (Fourteenth p. State Geologist New York for the year 1894, Albany, 1895 ted 1897], pp. 407–608, pls. A–E, i–xxv.) This report of the ologist also appears as part of the Forty-eighth Annual Report lew York State Museum.

a critical review of this work would require a volume in itself. The al introduction," "Bibliography of recent forms," and the account of the of the polypide, or living animal, are valuable, bringing together, as they useful knowledge. The list of North American species is but a condensa- Miller's North American Geology and Paleontology, without an attempt fer any of the species to the new genera described in succeeding pages of the k. The "Descriptions of Families and Genera" forms the most disappoint- f the work. Many new, and generally needless, family names are proposed. numerous similar examples, we may mention that the family Monticuli- defined as embracing forms with cystiphragms and no interstitial cells, and ew family, Prasoporidæ, is proposed for forms having cystiphragms and l cells. But the genus Monticulipora often has interstitial cells, and, more- pson figures it so. Many of the genera proposed are very artificial and in ne instance imaginary (see remark under Lyropora in the Catalogue follow- agnoses of genera by other authors are in some cases put in quotation marks, ntirely misquoted; misspellings of generic and specific names are frequent; of important genera are omitted, whether designedly or not is not stated; s reproductions of figures of other authors, and also of Hall and Simpson, under different names; some specific names, which are found nowhere else, without explanation or definition.

w generic names found in this handbook are Lyroporidra, Anastomopora, ella, Stictocella, Stictoporidra (page 527; called Stictoporina by error on , Fistuliporina, Fistuliporella, Ptilocella, Fistuliporidra, Fistulicella.

ves, J. F. The fossils of the Galena-Trenton and Black River mations of Lake Winnepeg and its vicinity. (Paleozoic Fossils, , Part II, 1897, pp. 129–242, pls. xvi–xxii.) Bryozoa, pp. –163, pls. xviii, xix (in part).

w species are Stomatopora Canadensis, Mesotrypa Selkirkensis.

1898.

Whiteaves, J. F. On some additional or imperfectly underst fossils from the Hamilton formation of Ontario, with a revi list of the species therefrom. (Contributions to Canadian Pale tology, I, Part V, 1898, pp. 361–418, pls. xlviii–l. Geol. Su Canada.) Bryozoa, pp. 376–382, pl. xlviii (in part).

One new species is described, Scalaripora Canadensis.

1899.

Grabau, Amadeus W. Geology and Paleontology of Eighteen-M Creek and the Lake Shore Sections of Erie County, New Yo Part II. Paleontology. (Bulletin of the Buffalo Society of N ural Sciences, VI, 1899, pp. 98–403, 263 figs.) Bryozoa, pp. 1 139, 158–179, figs. 47–77A.

In the fauna of this region the author enumerates, giving brief descriptions co or adapted from Hall and Simpson's Paleontology of New York, VI, or Simps Handbook of Genera, some forty species of bryozoa. Diagnoses are also given of genera used. One new species appears, Monotrypa amplectens.

1900.

Grabau, Amadeus W. The faunas of the Hamilton group of Eig een-Mile Creek and vicinity, in western New York. (Sixtee Annual Report of the State Geologist of New York for the y 1896, New York and Albany, 1899, [issued April, 1900], pp. 2 335.)

In the fauna is noted the occurrence of seven species of bryozoa. In a later w but appearing earlier (see under 1899), the author gives a full account of the b zoan fauna.

Rogers, Austin F. New Bryozoans from the coal measures of Ka and Missouri. (Kansas University Quarterly, ser. A, IX, No January, 1900, 12 pp., pls. i–iv.)

This paper came to hand too late to be incorporated into our work at any p but this. It contains good descriptions and figures of the following species, all n Stenopora spinulosa, spissa, Cystodictya inequimarginata, divisa, Streblotrypa ulri striatopora, Fenestella hexagonalis, dentata, kansasensis, ovatipora, missourie Polypora aspera, flexuosa, elliptica, triangularis, Thamniscus tenuiramus, Pinn pora pyriformipora, ptiloporoidea, multipora, Septopora interporata, Acanthocl pinnata, Rhombocladia delicata.

Rhombocladia is a new genus which the author refers provisionally to the A thocladiidæ. Streblotrypa ulrichi is a synonym for Streblotrypa prisca (Gabb Horn).

)LOGICAL CATALOGUE OF PAPERS CONTAINING DESCRIPTIONS AND STRATIONS OF AMERICAN MESOZOIC AND TERTIARY BRYOZOA, WITH S OF THE SPECIES DESCRIBED THEREIN.

n which an asterisk (*) precedes the name of the author are of special importance to the student of bryozoa.]

1829.

on, Samuel G. Note: Containing a notice of some fossils re-ntly discovered in New Jersey. In Vanuxem and Morton's oservations on the geology and organic remains of the Secondary, ertiary, and Alluvial formations of the Atlantic coast of the nited States of America. Philadelphia, 1828. (Extract from our. Acad. Nat. Sci. Philadelphia, VI, 1829, pp. 120–129.)

ge 62 (p. 124 of the Journal) the author records the occurrence of fragments ara, Flustra, and Retepora from the marl pits on Big Timber Creek.

1830.

on, Samuel G. Synopsis of the Organic Remains of the Ferru-nous Sand Formation of the United States. (Amer. Jour. Sci. rts, ser. 1, XVII, 1830, pp. 274–295.)

ge 288 the author notes the occurrence of fragments of Eschara, Flustra, and a from Gloucester County, New Jersey.

1833.

saac. Contributions to Geology. Philadelphia, 1833. 227 pp., pls.

oryozoa described are—
lites Bouei, p. 189, pl. vi, 202.
lites Duclosii, p. 190, pl. vi, 203.
olites interstitia, p. 191, pl. vi, 204.
olites discoidea, p. 192, pl. vi, 205.
e from the Eocene of Claiborne, Alabama.

1834.

on, Samuel G. Synopsis of the Organic Remains of the Creta-ous Group of the United States. Philadelphia, 1834. 88+8 pp.,) pls.

oryozoa described are—
ra digitata n. sp., p. 79, pl. xiii, 8.
ra sagena n. sp., p. 79, pl. xiii, 7.
oora sp. und., p. 79.
ome from the Cretaceous of New Jersey.

1841.

Conrad, T. A. Observations on the Secondary and Tertiar tions of the southern Atlantic States, by James T. Hodge an appendix by T. A. Conrad. (Amer. Jour. Sci. Art XLI, 1841, pp. 344–348.)

The bryozoa in the paper are—
Lunulites denticulata, p. 348.
Lunulites depressa, p. 348.
Medial Tertiary: Natural Well, Duplin County, North Carolina.

1845.

* **Lonsdale, William.** Account of six species of Polyparia from Timber Creek, New Jersey. (Quar. Jour. Geol. S don, I, 1845, pp. 65–75, 22 figs. in text.)

The bryozoa described are—
Idmonea contortilis n. sp., p. 68.
Tubulipora Megæra n. sp., p. 69.
Cellepora tubulata n. sp., p. 70.
Escharina ? sagena (Morton), p. 71.
Eschara digitata Morton, p. 73.

* **Lonsdale, William.** Report on the Corals from the Tertiar tions of North America. (Quar. Jour. Geol. Soc. L 1845, pp. 495–509.)

The following bryozoa are included in the paper:
Heteropora ? tortilis n. sp., p. 500. Miocene: Williamsburg, Petersbur
Escharina tumidula n. sp., p. 502. Miocene: Petersburg.
Lunulites denticulata Conrad, p. 503. Miocene: Petersburg.
Cellepora informata n. sp., p. 505. Miocene: Petersburg, Virginia.
Cellepora umbilicata n. sp., p. 507. Miocene: Petersburg.
Cellepora quadrangularis n. sp., p. 508. Miocene: Williamsburg, Eve
Cellepora similis n. sp., p. 509. Miocene: Williamsburg.

* **Lonsdale, William.** Account of twenty-six species of obtained from the Eocene Tertiary formation of Nort ica. (Quar. Jour. Geol. Soc. London, I, pp. 509–533.)

Tubulipora proboscidea ? (Milne-Edwards), p. 522. Eocene: Rock's
Idmonea maxillaris n. sp., p. 523. Eocene: Wantoot, South Carolina.
Idmonea commiscens n. sp., p. 524. Eocene: Rock's Bridge.
Hippothoa tuberculum n. sp., p. 527. Eocene: Rock's Bridge.
Eschara tubulata n. sp., p. 528. Eocene: Wilmington.
Eschara petiolus n. sp., p. 528. Eocene: Eutaw.
Eschara incumbens n. sp., p. 529. Eocene: Rock's Bridge.
Eschara linea n. sp., p. 530. Eocene: Eutaw.
Eschara viminea n. sp., p. 530. Eocene: Eutaw.
Lunulites sexangula n. sp., p. 531. Eocene: Wilmington.
Lunulites distans n. sp., p. 531. Eocene: Wilmington, Wantoot(?).
Lunulites contigua n. sp., p. 533. Eocene: Wilmington.

1847.

d, T. A. Observations on the Eocene formation, and descrip-
ons of one hundred and five new fossils of that period, from the
cinity of Vicksburg, Mississippi, with an appendix. (Proc.
cad. Nat. Sci. Philadelphia, III, 1847, pp. 280–299.)

lites Vicksburgensis, p. 296.

same paper occurs also in Journal Acad. Nat. Sci. Philadelphia, ser. 2, I,
. 111–134, pls. xi–xiv.

lites vicksburgensis, p. 127.

1855.

d, T. A. Note on the Miocene and Post-Pliocene deposits of
alifornia, with descriptions of two new fossil corals. (Proc.
cad. Nat. Sci. Philadelphia, VII, 1855, p. 441.)

nea Californica, p. 441. Miocene: Santa Barbara, California.

nopora Californica, p. 441. Miocene: Santa Barbara, California.

These deposits have since been determined to be of Pleistocene age.

1857.

ey, M., and **Holmes, F. S.** Pleiocene Fossils of South Caro-
a. Charleston, 1857. xvi+152 pp., 30 pls.

ryozoa are—

lites denticulata Conrad, p. 11, pl. iv, 1–5. Darlington district, South Carolina.

ora formosa n. sp., p. 12, pl. iv, 6. Darlington district, South Carolina.

ora tessellata n. sp., p. 13, pl. iv, 7. Giles Bluff, Peedee River.

ora radiata n. sp., p. 13, pl. iv, 8. Smith's, Goose Creek.

ora depressa n. sp., p. 14, pl. iv, 9. Smith's, Goose Creek.

oranipora lacinia n. sp., p. 14, pl. iv, 10. Smith's, Goose Creek.

celleporaria informata (Lonsdale), p. 15, pl. iv, 11, 12. Darlington district.

celleporaria similis (Lonsdale), p. 16, pl. iv, 13, 14. Darlington district,
arolina; Petersburg, Va.

opora tortilis Lonsdale, p. 16, pl. iv, 15, 16. Smith's, Goose Creek.

1858.

ons, Ebenezer. Report of the North Carolina Geological Sur-
y. Raleigh, 1858. Paleontology, pp. 193–314.

ryozoa described are—

lites denticulata, p. 311, figs. 248, 249. Miocene: Beds on Neuse and Cape
ers.

lites contigua, p. 311, figs. 250, 251. Eocene: Wilmington, North Carolina.

lites oblongus n. sp., p. 312, figs. 252, 253. Locality not given.

porella umbellata, p. 312, figs. 254, 255. Locality not given.

1860.

b, William M., and **Horn, George H.** Descriptions of new Cre-
ceous corals from New Jersey. (Proc. Acad. Nat. Sci. Phila-
lphia, XII, 1860, pp. 366–367.)

othoa irregularis, p. 366.

ora bilabiata, p. 366.

Cellepora carinata, p. 366.
Cellepora typica, p. 366.
Reticulipora sagena, p. 366.
Reptomulticava cepularis, p. 367.
Multicrescis parvicella, p. 367.
Localities are not given.

* **Gabb, William M.**, and **Horn, George H.** Descriptions of new sp
cies of American Tertiary and Cretaceous fossils. (Jour. Aca
Nat. Sci. Philadelphia, ser. 2, IV, 1860, pp. 375–404.)

The bryozoa described are—

Hypothoa irregularis G. & H., p. 400, pl. lxix, 18, 20. Cretaceous: Timber Cre
New Jersey.

Cellepora bilabiata G. & H., p. 400, pl. lxix, 21, 23. Cretaceous: Timber Cre
New Jersey.

Cellepora carinata G. & H., p. 400, pl. lxix, 24, 26. Cretaceous: Timber Cre
New Jersey.

Cellepora typica G. & H., p. 400, pl. lxix, 27, 29. Cretaceous: Marl of N
Jersey.

Reticulipora sagena G. & H., p. 400, pl. lxix, 30, 32. Cretaceous: Timber Cre
New Jersey.

Reptomulticava cepularis G. & H., p. 401, pl. lxix, 33, 35. Cretaceous: Tim
Creek, New Jersey.

Multicrescis parvicella G. & H., p. 401, pl. lxix, 36, 38. Cretaceous: Timber Cre
New Jersey.

Acerviclausa n. gen. G. & H., p. 403.

Acerviclausa vermicularis G. & H., p. 403, pl. lxix, 42, 44. Cretaceous: Near Mul
Hill, New Jersey.

Heterocrisina n. gen. G. & H., p. 404.

Heterocrisina Abbottii G. & H., p. 404, pl. lxix, 45, 47. Cretaceous: Near Mul
Hill, New Jersey.

Holmes, Francis S. Postpleiocene fossils of South Carolina. Charl
ton, 1860. xii+v+122 pp., 28 pls.

The bryozoa described are—

Reptocelleporaria informata (Lonsdale), p. 6, pl. i, 5. Charleston, South Caroli
Lunulites denticulata Conrad, p. 6, pl. ii, 4–4b. Simmons'; Abbapoola; St. Andrew

1862.

* **Gabb, William M.**, and **Horn, George H.** Monograph of the f
sil Polyzoa of the Secondary and Tertiary formations of Nor
America. (Jour. Acad. Nat. Sci. Philadelphia, ser. 2, V, 18
pp. 111–178, pls. xix–xxi.)

Eschara Lamarck, p. 114.

Eschara digitata Morton, p. 114. Cretaceous: Timber Creek and Mullica Hill, N
Jersey.

Eschara tubulata Lonsdale, p. 115. Eocene: Wilmington, North Carolina.
Eschara petiolus Lonsdale, p. 116. Eocene: Eutaw, South Carolina.
Eschara incumbens Lonsdale, p. 116. Eocene: Rock's Bridge.
Eschara ? viminea Lonsdale, p. 116. Eocene: Eutaw, South Carolina.
Eschara texta n. sp., p. 117, pl. xix, 1. Eocene: Charleston, South Carolina.
Eschara ovalis n. sp., p. 118, pl. xix, 2. Eocene: Claiborne, Alabama.
Eschara ? fragilissima n. sp., p. 118, pl. xix, 3. Miocene: St. Marys River, Marylan

ılites Lamarck, p. 119.

ılites sexangula Lonsdale, p. 119. Eocene: Wilmington, North Carolina.

ılites distans Lonsdale, p. 119. Locality not given.

ılites interstitia (Lea), p. 120. Eocene: Claiborne, Alabama.

ılites contigua Lonsdale, p. 121. Eocene: Wilmington, North Carolina.

ılites oblonga Emmons, p. 121. Miocene (?): North Carolina.

ieschara D'Orbigny, p. 121.

ieschara tubulata n. sp., p. 122, pl. xix, 5. Eocene: Claiborne, Alabama.

̣epora Fabricius, p. 122.

epora prolifica G. & H., p. 124. Cretaceous: Timber Creek, New Jersey.

epora exserta n. sp., p. 125, pl. xix, 6. Cretaceous: Mullica Hill, New Jersey.

epora Janewayi n. sp., p. 126, pl. xix, 7. Cretaceous: Seven miles below Yazoo, ippi.

epora pumila n. sp., p. 126, pl. xix, 8. Cretaceous: Timber Creek, New Jersey.

epora cycloris n. sp., p. 127, pl. xix, 9. Eocene: Claiborne, Alabama.

epora inornata n. sp., p. 127, pl. xix, 10. Eocene: (?) Claiborne, Alabama.

epora tumidula D'Orbigny, p. 127. Miocene: Petersburg, Virginia.

epora formosa Tuomey and Holmes, p. 129. Miocene (? Pliocene): Darlington ;, South Carolina.

epora tessellata Tuomey and Holmes, p. 129. Miocene (? Pliocene): Giles Bluff, River, South Carolina.

epora radiata Tuomey and Holmes, p. 129. Miocene (? Pliocene): Goose Creek, Carolina.

epora depressa Tuomey and Holmes, p. 129. Miocene (? Pliocene): Goose South Carolina.

epora urceolata n. sp., p. 129, pl. xix, 11, Miocene: New Jersey.

epora californiensis n. sp., p. 130, pl. xix, 12. Postpliocene: Santa Barbara, nia.

epora bellerophon n. sp., p. 130, pl. xix, 13. Postpliocene: Santa Barbara, nia.

ocelleporaria D'Orbigny, p. 131.

ocelleporaria aspera n. sp., p. 131, pl. xix, 14. Cretaceous: Timber Creek ar Mullica Hill, New Jersey.

ocelleporaria informata D'Orbigny, p. 132. Miocene: Petersburg, Virginia; uth Carolina.

ocelleporaria quadrangularis D'Orbigny, p. 132. Locality not given.

ocelleporaria similis D'Orbigny, p. 133. Miocene (? Pliocene): Virginia and Carolina.

ocelleporaria glomerata n. sp., p. 134, pl. xix, 15. Eocene: Vicksburg, ippi.

aripora D'Orbigny, p. 134.

aripora typica (G. & H.), p. 134, pl. xix, 16. Cretaceous: Timber Creek and ullica Hill, New Jersey.

arella D'Orbigny, p. 135.

arella micropora n. sp., p. 136, pl. xix, 17. Eocene: ? Alabama.

escharella D'Orbigny, p. 136.

escharella carolinensis n. sp., p. 136, pl. xix, 18. Eocene: Charleston, South ıa.

escharella Hermannii n. sp., p. 137, pl. xix, 20. Postpliocene: Santa Barbara, nia.

escharella plana n. sp., p. 137, pl. xix, 19. Postpliocene: Santa Barbara, nia.

idoloporidæ (new family), p. 138.

idolopora n. gen., p. 138.

Pholidolopora labiata n. sp., p. 138, pl. xix, 21. Postpliocene: Santa California.

Oligotresium n. gen., p. 139.

Oligotresium vicksburgensis (Conrad), p. 139, pl. xix, 22. Upper Eocene burg, Mississippi.

Escharinella D'Orbigny, p. 140.

Escharinella muralis n. sp., p. 140, pl. xix, 23. Cretaceous: Mullica H Jersey.

Escharinella ? linea (Lonsdale), p. 140. Eocene: Eutaw, South Carolina.

Ennallipora n. gen., p. 141.

Ennallipora quadrangularis n. sp., p. 141, pl. xx, 24. Miocene: Pet Virginia.

Discoporella D'Orbigny, p. 142.

Discoporella denticulata (Conrad), p. 142, pl. xx, 25. Miocene: Gener tributed from New Jersey to South Carolina.

Reptoporina D'Orbigny, p. 144.

Reptoporina carinata (G. & H.), p. 144. Locality not given.

Reptoporina customata n. sp., p. 144, pl. xx, 26. Postpliocene: Santa California.

Multiporina n. gen., p. 145.

Multiporina umbilicata (Lonsdale), p. 145, pl. xx, 27. Miocene: Pet Virginia.

Repteschareliina D'Orbigny, p. 146.

Repteschareniila prolifera n. sp., p. 146, pl. xx, 28. Cretaceous: Mulli New Jersey.

Repteschareniila disparilis n. sp., p. 147, pl. xx, 29. Postpliocene: Santa California.

Repteschareniila ? Hermannii n. sp., p. 147, pl. xx, 30. Postpliocene: Sa bara, California.

Repteschareniila cornuta n. sp., p. 147, pl. xx., 31. Postpliocene: Santa California.

Escharipora D'Orbigny, p. 148.

Escharipora distans n. sp., p. 148, pl. xx, 32. Cretaceous: Timber Creek, Ne

Escharipora Abbottii n. sp., p. 149, pl. xx, 33. Cretaceous: Mullica Hill, sey.

Escharipora immersa n. sp., p. 149. Cretaceous: Timber Creek, New Jers

Pliophloea, n. gen., p. 150.

Pliophloea sagena (Morton), p. 150, pl. xx, 34. Cretaceous: Timber Cr Mullica Hill, New Jersey.

Repteschariporа D'Orbigny, p. 151.

Repteschariporа marginata n. sp., p. 151, pl. xx, 35. Cretaceous: Mullica Jersey.

Biflustra D'Orbigny, p. 152.

Biflustra torta n. sp., p. 152, pl. xx, 36. Cretaceous: Timber Creek and Mul New Jersey.

Biflustra disjuncta n. sp., p. 153, pl. xx, 37. Cretaceous: Timber Creek and Hill, New Jersey.

Siphonella Hagenow, p. 154.

Siphonella multipora n. sp., p. 154, pl. xx, 38. Postpliocene: Santa Barba fornia.

Discoflustrellaria D'Orbigny, p. 154.

Discoflustrellaria Bouei (Lea), p. 154. Eocene: Claiborne, Alabama.

Cupularia Lamarck, p. 155.

Cupularia discoidea (Lea), p. 155. Eocene: Claiborne, Alabama.

actis n. gen., p. 156.
actis Duclosii (Lea), p. 156, pl. xx, 39. Eocene: Claiborne, Alabama.
ora D'Orbigny, p. 157.
ora irregularis (G. & H.), p. 157, pl. xx, 40. Cretaceous: Timber Creek and
Hill, New Jersey.
ranipora Blainville, p. 157.
ranipora abortiva n. sp., p. 157, pl. xx, 41. Cretaceous: Timber Creek and
Hill, New Jersey.
ranipora perampla n. sp., p. 158, pl. xx, 42. Cretaceous: Mullica Hill, New

ranipora plebia n. sp., p. 158, pl. xx, 43. Cretaceous: Mullica Hill, New Jer-

ranipora sexpunctata n. sp., p. 159, pl. xx, 44. Miocene or Eocene: Locality
n.
ranipora speciosa (G. & H.), p. 159, pl. xx, 45. Miocene (?): Chiriqui, Central
.
ranipora Californica n. sp., p. 160, pl. xx, 46. Postpliocene: Santa Barbara,
ia.
ranipora Barbarensis n. sp., p. 160, pl. xx, 47. Postpliocene: Santa Barbara,
ia.
ella D'Orbigny, p. 160.
ella capistrata n. sp., p. 161, pl. xx, 48. Cretaceous: Mullica Hill, New Jersey.
ella cylindrica n. sp., p. 161, pl. xx, 49. Cretaceous: Mullica Hill, New Jersey.
flustrella D'Orbigny, p. 161.
flustrella ? heteropora n. sp., p. 162, pl. xx, 50. Cretaceous: Mullica Hill and
Creek, New Jersey.
flustrella tubulata n. sp., p. 162, pl. xx, 51. With Membranipora sexpunctata.
unknown, probably from the Virginia Miocene.
ustrella D'Orbigny, p. 163.
ustrella tuberculum D'Orbigny, p. 163. Locality not given.
a D'Orbigny, p. 164.
a ovalis n. sp., p. 164, pl. xxi, 52. Cretaceous: Mullica Hill, New Jersey.
cigera D'Orbigny, p. 165.
cigera megæra (Lonsdale), p. 165, pl. xxi, 53. Cretaceous: Timber Creek,
sey.
ora D'Orbigny, p. 165.
ora Americana n. sp., p. 165, pl. xxi, 54. Cretaceous: Timber Creek and
Hill, New Jersey.
ora D'Orbigny, p. 166.
ora calamus n. sp., p. 166, pl. xxi, 55. Cretaceous: Timber Creek, New Jersey.
nea Lamouroux, p. 167.
nea contortilis Lonsdale, p. 167. Cretaceous: Timber Creek and Mullica Hill,
sey.
nea maxillaris Lonsdale, p. 167. Eocene: Wantoot, South Carolina.
nea commiscens Lonsdale, p. 168. Eocene: Rocks Bridge.
nea Californica Conrad, p. 168, pl. xxi, 56. Postpliocene: Santa Barbara,
ia.
ubigera D'Orbigny, p. 169.
ubigera tuba n. sp., p. 169, pl. xxi, 57. Postpliocene: Santa Barbara, California.
ophora Lamouroux, p. 170.
ophora quadrangularis n. sp., p. 170, pl. xxi, 58. Cretaceous: Timber Creek
llica Hill, New Jersey.
ophora Conradii n. sp., p. 170, pl. xxi, 59. Cretaceous: Mullica Hill, New

Entalophora proboscideoides (Lonsdale), p. 170, pl. xxi, 60. Eocene: ? Alaba

Entalophora punctulata n. sp., p. 171, pl. xxi, 61. Postpliocene: Santa Barb California.

Diastopora Lamouroux, p. 171.

Diastopora lineata n. sp., p. 172, pl. xxi, 62. Cretaceous: Timber Creek and M lica Hill, New Jersey.

Stomatopora Bronn, p. 172.

Stomatopora regularis n. sp., p. 172, pl. xxi, 63. Cretaceous: New Jersey.

Reticulipora D'Orbigny, p. 173.

Reticulipora sagena G. & H., p. 173. Cretaceous: Timber Creek, New Jersey.

Reticulipora dichotoma n. sp., p. 173, pl. xxi, 64. Cretaceous: Timber Creek, N Jersey.

Bicrisina D'Orbigny, p. 173.

Bicrisina Abbotii (G. & H.), p. 174, pl. xxi, 65. Cretaceous: Mullica Hill, N Jersey.

Crisina D'Orbigny, p. 174.

Crisina serrata n. sp., p. 174, pl. xxi, 66. Postpliocene: Santa Barbara, Califor

Cavea D'Orbigny, p. 175.

Cavea prisca n. sp., p. 175, pl. xxi, 67. Carboniferous (?): Fort Belknap, Texas.

Lichenopora Defrance, p. 176.

Lichenopora Californica Conrad, p. 176, pl. xxi, 68. Postpliocene: Santa Barb California.

Reptomulticava D'Orbigny, p. 176.

Reptomulticava cepularis G. & H., p. 177. Cretaceous: Timber Creek, New Jers

Crescis D'Orbigny, p. 177.

Crescis labiata n. sp., p. 177, pl. xxi, 69. Cretaceous: Mullica Hill and Tim Creek, New Jersey.

Multicrescis D'Orbigny, p. 178.

Multicrescis parvicella G. & H., p. 178. pl. xxi, 70. Cretaceous: Mullica Hill Timber Creek, New Jersey.

Multicrescis tortilis (Lonsdale), p. 178. Miocene (? Pliocene): Virginia and So Carolina.

Pumiscaria n. gen., p. 179. Type: "Alveolites glomeratus" Say, from the seac of New Jersey.

1870.

Credner, H. Die Kreide von New Jersey. (Zeitschriften der Deuts Geol. Gesellsch., XXII, 1870, pp. 191–251, pl. iv.)

Ditaxia compressa (Goldfuss), p. 220. Cretaceous: Timber Creek, New Jersey.

Eschara dichotoma (Goldfuss), p. 218. Cretaceous: Brownsville, New Jersey.

1879.

White, Charles A. Paleontological Papers No. 11. Remarks up certain Carboniferous fossils from Colorado, Arizona, Idaho, a Wyoming, and certain Cretaceous corals from Colorado, togeth with descriptions of new forms. (Bull. U. S. Geol. Geogr. S Terr. (Hayden's), V, pp. 209–221.)

Chætetes ?? demissus n. sp., p. 220. Cretaceous (Fox Hills group): Six m south of Fort Collins, Colorado.

The author is inclined to think this a bryozoan.

hite, Charles A. Report on the Paleontological Field Work for the season of 1877: Laramie Fossils. (**Eleventh Ann. Rep. U. S.** Geol. Geogr. Sur. Terr. (**Hayden's), 1879, pp. 161–272.**)

Iembranipora (?), **pp. 216, 217. Cretaceous** (**Laramie** group): Point of Rocks tion, Wyoming.

Iembranipora (?), p. 242. Cretaceous (Laramie group): Bear River Valley, oming.

1882.

rich, E. O. American Paleozoic Bryozoa. (Jour. Cincinnati Soc. Nat. Hist., V, 1882.)

Ieteropora attenuata n. sp., p. 144, pl. vi, 12. Cretaceous: Pulaski County, kansas.

Ieteropora consimilis n. sp., p. 145, pl. vi, 11. Cretaceous: Pulaski County, kansas.

1887.

hite, Charles A. Contributions to the paleontology of Brazil. [Contribuiçôes á Paleontologia do Brazil.] (Archivos do Museo Nacional do Rio de Janeiro, VII, 1887.)

unulites pileolus n. sp., pp. 208–209, pl. xviii, 21–23. Cretaceous: Rio Piabas, Procia do Pará, Brazil.

1890.

egorio, Antonio de. Monographie de la Faune Eocenique de l'Alabama et surtout de celle de Claiborne de l'Etage Parisien. (Annales de Géologie et de Paléontologie. Livraisons VII, VIII. Palermo, 1890. 316 pp., 46 pls.)

he bryozoa described from the Eocene of Claiborne, Alabama, are:
risia læta De Greg., p. 239, pl. 39, f. 10, 11.
Iyriozoum propepunctatum De Greg., p. 239, pl. 39, f. 12–13.
Iyriozoum fervens De Greg., p. 239, pl. 39, f. 14–15.
dmonea subdisticha De Greg., p. 239, pl. 39, f. 16–20.
ntalophora proboscidoides G. & H., p. 240, pl. 39, f. 26–27.
ntalophora amœna De Greg., p. 240, pl. 39, f. 21.
Iornera mirifica De Greg., p. 240, pl. 39, f. 31–32.
Iornera multiramosa De Greg., p. 240, pl. 39, f. 28–30.
Iornera claibornensis De Greg., p. 241, pl. 39, f. 22–23, 33–34.
Iornera sp. (?), p. 241, pl. 39, f. 24–25.
schara (?) spongiopsis De Greg., p. 241, pl. 40, f. 1–2.
schara ovalis G. & H., p. 241, pl. 40, f. 3–5.
scharella sifra De Greg., p. 242, pl. 40, f. 6–7.
scharella micropora G. & H., p. 242, pl. 40, f. 8–22, 23.
scharella micropora var. asperulata De Greg., p. 242, pl. 40, f. 21–22.
emieschara tubulata G. & H., p. 242, pl. 40, f. 24–28, 29–31.
incularia (?) insolita De Greg., p. 243, pl. 40, f. 32–37.
unulites (Discoflustrellaria) Bouei Lea, p. 243, pl. 41, f. 1–4, 5–6, 7–9; pl. 42, –6.
dem, var. concava De Greg., p. 244, pl. 41, f. 10–14.
dem, var. depressa De Greg., p. 244, pl. 41, f. 15–19.
dem, var. ellipsoides De Greg., p. 245, pl. 41, f. 20–21, 23–25.

Idem, var. Duclosii (Lea) De Greg., non G. & H., p. 245, pl. 41, f. 26–31, 32–
Idem, var. truncata De Greg., p. 245, pl. 41, f. 34–46.
Idem, var. almina De Greg., p. 246, pl. 42, f. 7–10.
Idem, var. tiza De Greg., p. 246, pl. 42, f. 11–12.
Idem, var. minutecellulata De Greg., p. 246, pl. 42, f. 13–15.
Batopora convivialis De Greg., p. 246, pl. 42, f. 30–33.
Cellepora inornata G. & H., p. 247, pl. 43, f. 2, 3–4.
Cellepora cycloris G. & H., p. 247, pl. 43, f. 1.
Celleporaria figula De Greg., p. 247, pl. 43, f. 5–6.
Biflustra (?) supradubia De Greg., p. 248, pl. 43, f. 11–12.
Membranipora simplex De Greg., p. 248, pl. 43, f. 7–8.
Membranipora contemplata De Greg., p. 248, pl. 43, f. 9–10.
Dimiclausa De Greg., n. subgen., p. 248.
Lunulites (Dimiclausa) fenestrata De Greg., p. 249, pl. 42, f. 23–27.
Lunulites (Cupularia) interstitia (Lea) De Greg., p. 249, pl. 42, f. 16–21, 22.
Cupularia discoidea Lea sp., p. 249, pl. 42, f. 28.
Lunulites distans Lonsdale, sp. dub., p. 250, pl. 42, f. 29.

)GUE OF THE GENERA AND SPECIES OF AMERICAN PALEOZOIC BRYOZOA, INCLUDING BIBLIOGRAPHY AND SYNONYMY.

THOCLADIA King. Genotype: Ceratophytes anceps Schlotheim.

9. Acanthocladia. King, Ann. Mag. Nat. Hist., ser. 2, II, p. 389.
0. Acanthocladia. King, Mon. British Permian Foss., p. 48.
0. Acanthocladia. Eichwald, Lethæa Rossica, I, p. 384.
0. Acanthocladia. Zittel, Handb. der Pal., p. 603.
5. Acanthocladia. Waagen and Pichl, Pal. Indica, Ser. XIII, p. 811.
6. Acanthocladia. Ulrich, Contr. American Pal., I, p. 6.
9. Acanthocladia. Miller, North American Geol. Pal., p. 291.
0. Acanthocladia. Ulrich, Geol. Surv. Illinois, VIII, pp. 398, 635.
6. Acanthocladia. Ulrich, Zittel's Textb. Pal. (Engl. ed.), p. 283.
7. Acanthocladia. Simpson, Fourteenth Ann. Rep. State Geologist New York for the year 1894, p. 522.

hocladia americana Swallow. Not recognizable.

8. Acanthocladia anceps ? Schlotheim. If distinct A. americana proposed. Swallow, Trans. St. Louis Acad. Sci., I, p. 180.
9. Acanthocladia americana. Shumard, Trans. St. Louis Acad. Sci., I, p. 388.
0. Acanthocladia americana. Meek and Hayden, Proc. Acad. Nat. Sci., Philadelphia, p. 24.

Lower Permian or Upper Coal Measures: Cottonwood Valley, Kansas; Guadalupe Mountains, Texas and New Mexico.

ıocladia anceps Swallow (not Schlotheim). See Acanthocladia ricana Swallow.

ıocladia fruticosa Ulrich.

0. Acanthocladia fruticosa. Ulrich, Geol. Surv. Illinois, VIII, p. 635, pl. lxv, 2–2c.

Upper Coal Measures: Springfield, Illinois.

THOCLEMA Hall. Genotype: Trematopora alternata Hall.

3. Acanthoclema. Hall, Fifth Ann. Rep. State Geologist New York for the year 1885, explanation pl. xxv.
7. Acanthoclema. Hall and Simpson, Pal. New York, VI, p. xv.
9. Acanthoclema. Miller, North American Geol. Pal., p. 291.
0. Acanthoclema. Ulrich, Geol. Surv. Illinois, VIII, pp. 402, 661.
7. Acanthoclema. Simpson, Fourteenth Ann. Rep. State Geologist New York for the year 1894, p. 552.

ıoclema alternatum (Hall).

3. Trematopora alternata. Hall, Trans. Albany Institute, X, p. 148 (abstract, 1881, p. 6).
3. Acanthoclema alternata. Hall, Fifth Ann. Rep. State Geologist New York for the year 1885, pl. xxv, 8–10.
7. Acanthoclema alternatum. Hall and Simpson, Pal. New York, VI, p. 72, pl. xxv, 8–10.

Acanthoclema alternatum (Hall)—Continued.
1897. Acanthoclema alternatum. Simpson, Fourteenth Ann. Rep. State Ge gist New York for the year 1894, pl. xvi, 6, 7.
Upper Helderberg: Onondaga Valley, New York.

Acanthoclema bispinulatum Miller. See Orthopora bispinulata (Ha

Acanthoclema confluens (Ulrich).
1888. Rhombopora confluens. Ulrich, Bull. Denison Univ., IV, p. 91, pl. xiv,
1890. Acanthoclema confluens, Ulrich. Geol. Surv. Illinois, VIII, p. 662, lxx, 5-5*b*.
Waverly: Lodi, Ohio.
Keokuk: Nauvoo, Illinois.

Acanthoclema divergens Hall and Simpson.
1883. Trematopora? sp. indt. Hall, Rep. State Geologist New York for the 1882, pl. xxv, 2.
1887. Acanthoclema divergens. Hall and Simpson, Pal. New York, VI, p. pl. xxviii, 2.
Upper Helderberg: Onondaga Valley, New York.

Acanthoclema Hamiltonense Hall and Simpson. See Streblotr hamiltonensis (Nicholson).

Acanthoclema ovatum Hall and Simpson.
1883. Trematopora? sp.indt. Hall, Rep. State Geologist New York for the 1882, pl. xxv, 3.
1887. Acanthoclema ovatum. Hall and Simpson, Pal. New York, VI, p. 73, xxviii, 3.
Upper Helderberg: Onondaga Valley, New York.

Acanthoclema scutulatum Hall and Simpson. See Streblotrypa scu lata (Hall) and Rhombopora reticulata (Hall).

Acanthoclema sulcatum Hall and Simpson.
1887. Acanthoclema sulcatum. Hall and Simpson, Pal. New York, VI, p. pl. lv. 7, pl. lvi. 7.
Hamilton: Near Canandaigua Lake, New York.

Acanthoclema triseriale (Hall).
1883. Stictopora? triserialis. Hall, Rep. State Geologist New York for the 1882, pl. xxv, 6, 7.
1887. Acanthoclema triseriale, Hall and Simpson, Pal. New York, VI, p. 74, xxviii, 6, 7.
Upper Helderberg: Near Caledonia, New York.

ACROGENIA Hall. Genotype: Acrogenia prolifera Hall.
1883. Acrogenia. Hall, Trans. Albany Institute, X, p. 193 (abstract, 1881, p.
1884. Acrogenia. Hall, Rep. State Geologist New York for the year 1883, p.
1887. Acrogenia. Hall and Simpson, Pal. New York, VI, p. xx.
1889. Acrogenia. Miller, North American Geol. Pal., p. 291.
1890. Acrogenia. Ulrich, Geol. Surv. Illinois, VIII, p. 388.
1897. Acrogenia. Simpson, Fourteenth Ann. Rep. State Geologist New Y for the year 1894, p. 544.
1899. Acrogenia. Grabau, Bull. Buffalo Acad. Nat. Sci., VI, p. 175.

Acrogenia prolifera Hall.
1883. Acrogenia prolifera. Hall, Trans. Albany Institute, X, p. 194 (abst 1881, p. 194).

genia prolifera Hall—Continued.

884. Acrogenia prolifera. Hall, Rep. State Geologist New York for the year 1883, p. 52.

887. Acrogenia prolifera. Hall and Simpson, Pal. New York, VI, p. 267, pl. lxiii, 7–15.

889. Acrogenia prolifera. Miller, North American Geol. Pal., fig. 448 (p. 291).

897. Acrogenia prolifera. Simpson, Fourteenth Ann. Rep. State Geologist New York for the year 1894, pl. xv, 11–20.

899. Acrogenia prolifera. Grabau, Bull. Buffalo Acad. Nat. Sci., VI, p. 175, fig. 72.

Hamilton: Bellona, Lodi Landing (Seneca Lake), and Darien Center, New York.

nostoma. Young and Young. See Fenestella Lonsdale.

NOTRYPA Ulrich. Genotype: Fistulipora peculiaris Rominger.

889. Actinotrypa. (Ulrich, in press), Miller, North American Geol. Pal., p. 291.

890. Actinotrypa. Ulrich, Geol. Surv. Illinois, VIII, p. 386.

897. Actinotrypa. Simpson, Fourteenth Ann. Rep. State Geologist New York for the year 1894, p. 540.

otrypa peculiaris (Rominger).

866. Fistulipora peculiaris. Rominger, Proc. Acad. Nat. Sci. Philadelphia, p. 123.

890. Actinotrypa peculiaris. Ulrich, Geol. Surv. Illinois, VIII, p. 503, pl. lxxvii, 3–3*b*.

894. Actinotrypa peculiaris. Keyes, Missouri Geol. Surv., V, p. 18, pl. xxxiv, 6.

897. Actinotrypa peculiaris. Simpson, Fourteenth Ann. Rep. State Geologist New York for the year 1894, figs. 97–99 (p. 540).

Keokuk: Lagrange, Missouri; Keokuk, Iowa; Warsaw and Nauvoo, Illinois.

to of authors. See Stomatopora Bronn.

to auloporoides Nicholson. See Proboscina auloporoides (Nichol-
n).

to? Canadensis Nicholson. See Hederella canadensis (Nicholson).

to confusa Nicholson. See Proboscina confusa (Nicholson).

to frondosa Nicholson. See Proboscina frondosa (Nicholson).

to inflata Hall. See Stomatopora inflata (Hall).

to nexilis James. See Batostoma implicatum (Nicholson).

olites Lamarck. Not a bryozoan genus.

olites expansa James. See Ceramopora expansa (James).

olites exsul Hall. See Lioclema? exsul (Hall).

olites irregularis Whitfield. See Ceramoporella? irregularis (Whitfield).

LEXOPORA Ulrich. Genotype: Amplexopora cingulata Ulrich.

882. Amplexopora. Ulrich, Jour. Cincinnati Soc. Nat. Hist., V, p. 154.

883. Amplexopora. Foord, Contr. Micro-Pal. Cambro.-Sil., p. 15.

889. Amplexopora. Miller, North American Geol. Pal., p. 291.

890. Ámplexopora. Ulrich, Geol. Surv. Illinois, VIII, pp. 377, 450.

896. Amplexopora. Ulrich, Zittel's Textb. Pal. (Engl. Ed.), p. 278.

897. Amplexopora. Simpson, Fourteenth Ann. Rep. State Geologist New York for the year 1894, p. 577.

Amplexopora affinis Ulrich. See Heterotrypa affinis (Ulrich

Amplexopora barrandei Ulrich. See Heterotrypa ? barrande olson).

Amplexopora Canadensis Foord. See Batostoma canadense

Amplexopora cingulata Ulrich.

1882. Amplexopora cingulata. Ulrich, Jour. Cincinnati Soc. Nat. H 254, pl. xi, 5–5*c*.
1889. Amplexopora cingulata. Miller, North American Geol. Pal., 292).
1890. Amplexopora cingulata. Ulrich, Geol. Surv. Illinois, VIII, 308), fig. 4*c* (p. 309).
1894. Amplexopora cingulata. J. F. James, Jour. Cincinnati Soc. XVI, p. 193.
Cincinnati (Lorraine): McKinney's Station and Boyle County, Cincinnati, Ohio.

Amplexopora ? discoidea (Nicholson).

1871. Chætetes discoideus. James, Catal. Foss. Cincinnati group. (N only named.)
1874. Chætetes discoideus. Nicholson, Quar. Jour. Geol. Soc. Lond p. 511, pl. xxx, 4–4*d*.
1875. Chætetes discoideus. Nicholson, Pal. Ohio, II, p. 206, pl. xxi,
1875. Chætetes discoideus. Nicholson, Pal. Province Ontario, pp. 10,
1876. Chætetes discoideus. Nicholson, Ann. Mag. Nat. Hist., ser. p. 88, pl. v, 7, 7*a*.
1881. Monticulipora (Monotrypa) discoidea. Nicholson, Genus Mon p. 193, pl. iv, 3–3*f*.
1882. Amplexopora discoidea. Ulrich, Jour. Cincinnati Soc. Nat. p. 255.
1883. Leptotrypa discoidea. Ulrich, Jour. Cincinnati Soc. Nat. Hist.,
1883. Amplexopora discoidea. Foord, Contr. Micro-Pal. Cambro-Sil.
1883. Monticulipora discoidea. Hall, Twelfth Ann. Rep. Indiana Hist., p. 247, pl. x, 4, 5.
1888. Monticulipora discoidea. James and James, Jour. Cincinnati Hist., X, p. 163.
1894. Monticulipora discoidea. J. F. James, Jour. Cincinnati Soc. XVI, p. 178.
Cincinnati (Lorraine): Cincinnati, Ohio, and vicinity.
Trenton: Ottawa (Foord) and Weston (Nicholson), Canada.
Obs. The forms from Canada identified as Amplexopora di Nicholson and by Foord may be specifically distinct.

Amplexopora filiosa (D'Orbigny).

1850. Monticulipora filiasa. D'Orbigny, Prodr. de Pal., I, p. 25.
1851. Chætetes filiasa. Milne-Edwards and Haime, Pol. Foss. Terr.
1860. Monticulipora filiosa. Milne-Edwards, Hist. Nat. des Corall.,
1875. Chætetes filiasa (?). Nicholson, Pal. Ohio, II, p. 206.
1883. Monotrypa (?) filiasa. Ulrich, Jour. Cincinnati Soc. Nat. Hist.,
1888. Monticulipora filiasa. James and James, Jour. Cincinnati Soc. X, p. 162.
1890. Leptotrypa filiosa. Ulrich, Geol. Surv. Illinois, VIII, p. 456, 7, 7*a*.
1893. Monticulipora filiasa. J. F. James, Jour. Cincinnati Soc. Nat. p. 158.

lexopora filiosa (D'Orbigny)—Continued.

1896. Monticulipora subcylindrica (James, U. P., *mss.*). J. F. James, Jour Cincinnati Soc. Nat. Hist., XVIII, p. 123, fig. 13*a–c*.

Cincinnati (Lorraine): Cincinnati, Ohio, and vicinity; Maury County, Tennessee. Trenton: Calhoun County, Illinois (Ulrich).

Obs. The form from Calhoun County, Illinois, identified as above, is probably specifically distinct.

lexopora moniliformis Ulrich. See Heterotrypa? moniliformis icholson).

lexopora petasiformis (Nicholson).

878. Chætetes petropolitanus. James, Paleontologist, No. 2, p. 11.

881. Monticulipora (Monotrypa) petasiformis. Nicholson, Genus Monticulipora, p. 190, fig. 40.

882. Monotrypa petasiformis. Ulrich, Jour. Cincinnati Soc. Nat. Hist., V, p. 256.

883. Monotrypa? petasiformis. Ulrich, Jour. Cincinnati Soc. Nat. Hist., VI, p. 163.

888. Monticulipora petasiformis. James and James, Jour. Cincinnati Soc. Nat. Hist., X, p. 168.

894. Monticulipora petasiformis. J. F. James, Jour. Cincinnati Soc. Nat. Hist., XVI, p. 186.

Cincinnati (Utica): Cincinnati, Ohio, and vicinity.

lexopora petasiformis–welchi (James).

882. Monticulipora (Monotrypa) welchi. James, Paleontologist, No. 6, p. 50. ibid., No. 7, pl. i, 4–4*c*, 1883.

888. Monticulipora petasiformis var. welchi. James and James, Jour. Cincinnati Soc. Nat. Hist., X, p. 169.

894. Monticulipora petasiformis var. welchi. J. F. James, Jour. Cincinnati Soc. Nat. Hist., XVI, p. 187.

Cincinnati (Utica): Cincinnati, Ohio, and vicinity.

lexopora pustulosa Ulrich.

890. Amplexopora pustulosa. Ulrich, Geol. Surv. Illinois, VIII, p. 451, pl. xxxvi, 3–3*c*.

895. Monticulipora pustulosa. J. F. James, Jour. Cincinnati Soc. Nat. Hist., XVIII, p. 72.

Cincinnati (Richmond): Hanover and Clarksville, Ohio.

lexopora robusta Ulrich.

883. Amplexopora robusta. Ulrich, Jour. Cincinnati Soc. Nat. Hist., VI, p. 82, pl. i, 1–1*b*.

889. Amplexopora robusta. Miller, North American Geol. Pal., fig. 450 (p. 292).

890. Amplexopora robusta. Ulrich, Geol. Surv. Illinois, VIII, fig. 7*d* (p. 318).

Cincinnati (Lorraine): Cincinnati, Ohio; Boyle County, Kentucky.

lexopora septosa (Ulrich).

879. Atactopora septosa. Ulrich, Jour. Cincinnati Soc. Nat. Hist., II, p. 125, pl. xii, 7–7*c*.

882. Amplexopora septosa. Ulrich, Jour. Cincinnati Soc. Nat. Hist., V, p. 255.

888. Monticulipora septosa. James and James, Jour. Cincinnati Soc. Nat. Hist., X, p. 180.

894. Monticulipora septosa. J. F. James, Jour. Cincinnati Soc. Nat. Hist., XVI, p. 203.

Cincinnati (Utica and Lorraine): Covington and Newport, Kentucky; Cincinnati, Ohio.

Amplexopora superba Foord. - See Batostoma superbum (Foo

Amplexopora superba Ulrich (not Foord). See Batostoma r
tense Ulrich.

Amplexopora winchelli Ulrich. See Batostoma winchelli (Ul

Anastomopora Simpson. See Reteporidra.

Anastomopora cinctuta Simpson. See Reteporidra cinctuta (

ANISOTRYPA Ulrich. Genotype: Anisotrypa symmetrica U

1883. Anisotrypa. Ulrich, Jour. Cincinnati Soc. Nat. Hist., VI, p. 275.
1889. Anisotrypa. Miller, North American Geol. Pal., p. 292.
1890. Anisotrypa. Ulrich, Geol. Surv. Illinois, VIII, pp. 376, 447.
1896. Anisotrypa. Ulrich, Zittel's Textb. Pal. (Engl. ed.), p. 277.

Anisotrypa elegantula Ulrich. See Rhombopora elegantula (

Anisotrypa fistulosa Ulrich.

1890. Anisotrypa fistulosa. Ulrich, Geol. Surv. Illinois, VIII, p. 448,
6–6*c*.
Ste. Genevieve: Pella, Iowa.

Anisotrypa ramulosa Ulrich.

1890. Anisotrypa ramulosa. Ulrich, Geol. Surv. Illinois, VIII, p. 449
7–7*a*.
Ste. Genevieve: Pella, Iowa.

Anisotrypa solida Ulrich.

1890. Anisotrypa solida. Ulrich, Geol. Surv. Illinois, VIII, p. 449, pl. l
1894. Anisotrypa solida. Keyes, Missouri Geol. Surv., V, p. 16.
Chester: Sloans Valley, Kentucky; Chester, Illinois.

Anisotrypa symmetrica Ulrich.

1883. Anisotrypa symmetrica. Ulrich, Jour. Cincinnati Soc. Nat. Hi
276, pl. xiii, 5–5*c*.
1890. Anisotrypa symmetrica. Ulrich, Geol. Surv. Illinois, VIII, p
lxxii, 5.
Chester: Grayson Springs and Sloans Valley, Kentucky; Cheste

ANOLOTICHIA Ulrich. Genotype: Anolotichia ponderosa Ul

1890. Anolotichia. Ulrich, Geol. Surv. Illinois, VIII, pp. 381, 473.
1893. Anolotichia. Ulrich, Geol. Minnesota, III, p. 326.
1896. Anolotichia. Ulrich, Zittel's Textb. Pal. (Engl. ed.), p. 268.

Anolotichia impolita (Ulrich).

1886. Crepipora impolita. Ulrich, Fourteenth Ann. Rep. Geol. Nat. H
Minnesota, p. 77.
1893. Anolotichia impolita. Ulrich, Geol. Minnesota, III, p. 327, pl. xx
1896. Anolotichia impolita. Ulrich, Zittel's Textb. Pal. (Engl.
437A–C (p. 268).
Trenton (Stones River): Minneapolis, St. Paul, Chatfield, Can
Lanesboro, and Fountain, Minnesota.

Anolotichia ponderosa Ulrich.

1890. Anolotichia ponderosa. Ulrich, Geol. Surv. Illinois, VIII, p. 4
3–3*d*, fig. 8*c* (p. 320).
1896. Anolotichia ponderosa. Ulrich, Zittel's Textb. Pal. (Engl. ed.)
(p. 268).
Cincinnati (Richmond): Wilmington, Illinois.

Arcanopora Vine. See Cystodictya Ulrich.

HIMEDES Owen. Genotype: Archimedes wortheni (Hall).

842. Archimedes. (Le Seuer) Owen, American Jour. Sci., XLIII, p. 19.
857. Archimedes. Hall, Proc. American Assoc. Adv. Sci., X, p. 176.
858. Archimedes. Hall, Pal. Iowa, p. 651.
882. Archimedes. Ulrich, Jour. Cincinnati Soc. Nat. Hist., V, p. 150.
883. Archimedes. Claypole, Quar. Jour. Geol. Soc. London, XXXIX, p. 31.
885. Archimedes. Hall, Rep. State Geologist New York for the year 1884, p. 37.
885. Archimedes. Waagen and Pichl, Pal. Indica, Ser. XIII, p. 774.
886. Archimedes. Ulrich, Contr. American Pal., I, p. 5.
889. Archimedes. Miller, North American Geol. Pal., p. 292.
890. Archimedes. Ulrich, Geol. Surv. Illinois, VIII, pp. 396, 565.
895. Archimedes. Simpson, Thirteenth Ann. Rep. State Geologist New York for the year 1893, p. 726; Forty-fourth Ann. Rep. New York State Museum, p. 920.
896. Archimedes. Ulrich, Zittel's Textb. Pal. (Engl. ed.), p. 282.
897. Archimedes. Simpson, Fourteenth Ann. Rep. State Geologist New York for the year 1894, pp. 519, 522.
850. Archimedipora. D'Orbigny, Prodr. de Pal., I, p. 102.

imedes communis Ulrich.

890. Archimedes communis. Ulrich, Geol. Surv. Illinois, VIII, p. 573, pl. lxiii, 1–1*d*.
Chester: Sloans Valley, Kentucky.

imedes compactus Ulrich.

890. Archimedes compactus. Ulrich, Geol. Surv. Illinois, VIII, p. 572, pl. lxiii, 2–2*b*, 2*d* (not 2*c*).
Chester: Sloans Valley, Kentucky.

imedes distans Ulrich.

890. Archimedes distans. Ulrich, Geol. Surv. Illinois, VIII, p. 578, pl. lxiii, 9–9*b*.
Chester: Chester, Illinois; Sloans Valley, Kentucky.

imedes grandis Ulrich.

890. Archimedes grandis. Ulrich, Geol. Surv. Illinois, VIII, p. 569, pl. lxiii, 10.
Keokuk: Jersey County, Illinois.

imedes intermedius Ulrich.

890. Archimedes intermedius. Ulrich, Geol. Surv. Illinois, VIII, p. 574, pl. lxiii, 2*c*.
Chester: Chester, Illinois; Sloans Valley, Kentucky.

imedes invaginatus Ulrich.

890. Archimedes invaginatus. Ulrich, Geol. Surv. Illinois, VIII, p. 575, pl. lxiii, 11*a*, 11*c*.
Chester: Chester, Illinois.

imedes laxa White (not Hall). See Archimedes owenanus (Hall).

imedes laxus (Hall).

857. Fenestella (Archimedes) laxa. Hall, Proc. American Assoc. Adv. Sci., X, p. 178.
890. Archimedes laxus. Ulrich, Geol. Surv. Illinois, VIII, p. 580, pl. lxiii, 15, 15*a*.
894. Archimedes laxus. Keyes, Missouri Geol. Surv., V, p. 27.
883. Helicopora archimediformis. Claypole, Quar. Jour. Geol. Soc. London, XXXIX, p. 34, pl. iv, 3, 4.

Archimedes laxus (Hall)—Continued.

1897. Helicopora archimediformis. Simpson, Fourteenth Ann. Rep. ogist New York for the year 1894, fig. 70, 3, 4 (p. 518).
Chester: Chester, Illinois; Litchfield, Kentucky.

Archimedes meekanus (Hall).

1857. Fenestella (Archimedes) Meekana. Hall, Proc. American Sci., X, p. 178.
1890. Archimedes meekanus. Ulrich, Geol. Surv. Illinois, VIII, p. 578
Chester: Chester, Illinois; Sloans Valley and Grayson Springs,

Archimedes negligens Ulrich.

1890. Archimedes negligens. Ulrich, Geol. Surv. Illinois, VIII, p. 5 7, 7*a*.
Keokuk: Keokuk and Bentonsport, Iowa.

Archimedes owenanus (Hall).

1857. Fenestella (Archimedes) Owenana. Hall, Proc. American Sci., X, p. 178.
1890. Archimedes owenanus. Ulrich, Geol. Surv. Illinois, VIII, p. 5 6–6*c*.
1894. Archimedes owenanus. Keyes, Missouri Geol. Surv., V, p. 26, p
1882. Archimedes laxa. White, Eleventh Ann. Rep. Indiana Geol. N 361, pl. xli, 7.
Keokuk: Keokuk, Iowa; Appanoosa, near Quincy, Illinois; ville, Missouri.

Archimedes perminimus Ulrich.

1890. Archimedes perminimus. Ulrich, Geol. Surv. Illinois, VIII, lxiii, 13, 11 (in part).
Chester: Chester, Illinois.

Archimedes proutanus Ulrich.

1890. Archimedes proutanus. Ulrich, Geol. Surv. Illinois, VIII, p. 5 3–3*c*, 11, 11*b*.
Chester: Sloans Valley, Kentucky; Chester, Illinois.

Archimedes reversa Hall. See Archimedes wortheni Hall.

Archimedes sublaxus Ulrich.

1890. Archimedes sublaxus. Ulrich, Geol. Surv. Illinois, VIII, p. 579,
Chester: Chester, Illinois.

Archimedes swallovanus (Hall).

1857. Fenestella (Archimedes) Swallovana. Hall, Proc. American Sci., X, p. 178.
1890. Archimedes swallovanus. Ulrich, Geol. Surv. Illinois, VIII, p. 5 12–12*d*.
1894. Archimedes swallovanus. Keyes, Missouri Geol. Surv., V, p.
Chester: Chester and Kaskaskia, Illinois; Crittenden County,

Archimedes terebriformis Ulrich.

1890. Archimedes terebriformis. Ulrich, Geol. Surv. Illinois, VIII, lxiii, 5–5*c*.
Chester: Chester, Illinois; Sloans Valley and Grayson Springs,

Archimedes wortheni (Hall).

1852. Retepora archimedes. Owen, Rep. Geol. Surv. Wisconsin, Minnesota, pl. iv, 1.

nedes wortheni (Hall)—Continued.

31. Retepora Archimedes. Quenstedt, Roehren- und Sternkorallen, p. 174, pl. cl. 4–10.

57. Fenestella (Archimedes) Wortheni. Hall, Proc. American Assoc. Adv. Sci., X, p. 178.

58. Archimedes Wortheni. Hall, Pal. Iowa, p. 651, pl. xxii, 3, 4*a*, *b*, 5*a*, *b*.

39. Archimedes wortheni. Miller, North American Geol. Pal., fig 452 (p. 292).

0. Archimedes wortheni. Ulrich, Geol. Surv. Illinois, VIII, p. 571, pl. lxiii, 8, 8*a*.

4. Archimedes wortheni. Keyes, Missouri Geol. Surv., V, p. 26, pl. xxxiii, 1.

6. Archimedes Wortheni. Ulrich, Zittel's Textb. Pal. (Engl. ed.), fig. 468 (p. 282).

7. Archimedes Wortheni. Simpson, Fourteenth Ann. Rep. State Geologist New York for the year 1894, figs. 71, 72 (p. 519).

58. Archimedes reversa. Hall, Pal. Iowa, p. 652, pl. xxii, 2.

39. Archimedes reversus. Miller, North American Geol. Pal., fig. 451 (p. 292).

Warsaw: Warsaw, Illinois.

medipora D'Orbigny. See Archimedes Owen.

medipora Simpson (not D'Orbigny).

5. Archimediopora. Simpson, Thirteenth Ann. Rep. State Geologist New York for the year 1893, pp. 701, 723, 726; Forty-seventh Ann. Rep. New York State Mus., pp. 895, 917, 920.

7. Archimedipora. Simpson, Fourteenth Ann. Rep. State Geologist New York for the year 1894, p. 522.

Obs. This genus as defined by Mr. Simpson is imaginary. The author cites no species. We know of no species of Archimedes with more than two rows of apertures on a branch.

ROCLEMA Billings. Genotype: Arthroclema pulchellum Billings.

32. Arthroclema. Billings, Pal. Foss., I, p. 54.

32. Arthroclema (in part). Ulrich, Jour. Cincinnati Soc. Nat. Hist., V, p. 151.

36. Arthroclema. Ulrich, Fourteenth Ann. Rep. Geol. Nat. Hist. Surv. Minnesota, p. 60.

38. Arthroclema. Ulrich, American Geologist, I, p. 232.

39. Arthroclema. Miller, North American Geol. Pal., p. 293.

0. Arthroclema. Ulrich, Jour. Cincinnati Soc. Nat. Hist., XII, p. 192.

0. Arthroclema. Ulrich, Geol. Surv. Illinois, VIII, p. 400.

3. Arthroclema. Ulrich, Geol. Minn., III, p. 197.

6. Arthroclema. Ulrich, Zittel's Textb. Pal. (Engl. ed.), p. 281.

7. Arthroclema. Simpson, Fourteenth Ann. Rep. State Geologist, New York, for the year 1894, p. 546.

oclema angulare Ulrich.

39. Arthroclema angulare. Ulrich, Contr. Micro-Pal. Cambro-Sil., Part II, p. 45.

0. Arthroclema angulare. Ulrich, Geol. Surv. Illinois, VIII, p. 641, pl. xxix, 6–6*b*.

5. Arthroclema angulare. Whiteaves, Pal. Foss., III, p. 117.

Cincinnati (Richmond): Wilmington, Illinois; Stony Mountain, Manitoba.

Obs. See Helopora imbricata Ulrich.

oclema armatum Ulrich.

0. Arthroclema armatum. Ulrich, Jour. Cincinnati Soc. Nat. Hist., XII, p. 194, fig. 19*a*–*d* (not *e*–*h*=Arthroclema pulchellum Billings).

3. Arthroclema armatum. Ulrich, Geol. Minnesota, III, p. 201, pl. ii, 8–11, 25, 28–33, pl. iii, 7.

Arthroclema armatum Ulrich—Continued.

1897. Arthroclema armatum. Simpson, Fourteenth Ann. Rep. State Geol New York for the year 1894, fig. 111 (p. 547).
Trenton: Cannon Falls and St. Paul, Minnesota.

Arthroclema billingsi Ulrich.

1890. Arthroclema billingsi. Ulrich, Geol. Surv. Illinois, VIII, p. 642.
1893. Arthroclema billingsi. Ulrich, Geol. Minnesota, III, p. 197, pl. ii, 7.
1897. Arthroclema Billingsi. Simpson, Fourteenth Ann. Rep. State Geol New York for the year 1894, fig. 105 (p. 547).
Trenton: Ottawa, Canada.

Arthroclema cornutum Ulrich.

1890. Arthroclema cornutum. Ulrich, Jour. Cincinnati Soc. Nat. Hist., p. 193, fig. 18.
1893. Arthroclema cornutum. Ulrich, Geol. Minnesota, III, p. 200, pl. ii, 1 23, pl. iii, 34.
1897. Arthroclema cornutum. Simpson, Fourteenth Ann. Rep. State Geol New York for the year 1894, figs. 106–108, 112 (p. 547).
Trenton (Black River): Minneapolis, Minnesota.

Arthroclema pulchellum Billings.

1862. Arthroclema pulchellum. Billings, Pal. Foss., I, p. 54, fig. 60.
1890. Arthroclema pulchellum. Ulrich, Geol. Surv. Illinois, VIII, p. 642 xxix, 6c.
1893. Arthroclema pulchellum. Ulrich, Geol. Minnesota, III, pl. ii, 12–15.
1890. Arthroclema armatum (in part). Ulrich, Jour. Cincinnati Soc. Hist., XII, p. 194, fig. 19 *e–h* (not 19 *a–d*).
Trenton: Ottawa City and Peterboro, Canada.

Arthroclema spiniforme Ulrich. See Helopora spiniformis (Ulric

Arthroclema striatum Ulrich.

1893. Arthroclema striatum. Ulrich, Geol. Minn., III, p. 198, pl. ii, 2 pl. iii, 28–33.
1897. Arthroclema striatum. Simpson, Fourteenth Ann. Rep. State Geol New York for the year 1894, figs. 109, 110 (p. 547).
Trenton (Black River): Minneapolis and St. Paul, Minnesota.

Arthronema Ulrich (preoccupied). See Arthrostylus Ulrich.

Arthronema curtum Ulrich. See Arthrostylus curtus (Ulrich).

Arthronema tenue Ulrich. See Arthrostylus tenuis (James).

ARTHROPORA Ulrich. Genotype: Ptilodictya (Stictopora) Sha Meek.

1882. Arthropora. Ulrich, Jour. Cincinnati Soc. Nat. Hist., V, pp. 152, 167.
1889. Arthropora. Miller, North American Geol. Pal., p. 293.
1890. Arthropora. Ulrich, Geol. Surv. Illinois, VIII, p. 393.
1893. Arthropora. Ulrich, Geol. Minnesota, III, p. 176.
1896. Arthropora. Ulrich, Zittel's Textb. Pal. (Engl. ed.), p. 279.
1897. Arthropora. Simpson, Fourteenth Ann. Rep. State Geologist New for the year 1894, p. 605.

Arthropora bifurcata Ulrich.

1893. Arthropora bifurcata. Ulrich, Geol. Minnesota, III, p. 178, pl. xiv, 22–
Trenton (Black River): St. Paul and Cannon Falls, Minnesota.

Arthropora reversa Ulrich.

1893. Arthropora reversa. Ulrich, Geol. Minnesota, III, p. 178, pl. xiv, 26.
Trenton: St. Paul, Minnesota.

pora shafferi (Meek).

2. Ptilodictya (Stictopora) Shafferi. Meek, Proc. Acad. Nat. Sci. Philadelphia, p. 317.
3. Ptilodictya (Stictopora) Shafferi. Meek, Pal. Ohio, I, p. 69, pl. v. 1*a*–*c*.
5. Ptilodictya Shafferi. Nicholson, Pal. Province Ontario, p. 33, fig. 4.
2. Arthropora shafferi. Ulrich, Jour. Cincinnati Soc. Nat. Hist., V, p. 167, pl. vii, 10, 10*a*.
9. Arthropora shafferi. Miller, North American Geol. Pal., figs. 453–455 (p. 293).
0. Arthropora shafferi. Ulrich, Geol. Surv. Illinois, VIII, fig. 3*e* (p. 308).
9. Crateripora erecta. Ulrich, Jour. Cincinnati Soc. Nat. Hist., II, p. 29, pl. vii, 29, 29*a*.
9. Stromatopora (?) lichenoides. James, Paleontologist, No. 3, p. 18.

Cincinnati (Lorraine): Cincinnati, Ohio, and vicinity.

Obs. The names Crateripora erecta Ulrich and Stromatopora (?) lichenoides James were applied to the articulating basal socket of this species before its true nature was understood.

pora shafferi-cleavelandi (James).

1. Ptilodictya cleavelandi. James, Paleontologist, No. 5, p. 38.
1. Ptilodictya? cincinnatiensis. James, Paleontologist, No. 5, p. 39.
1. Ptilodictya grahami. James, Paleontologist, No. 5, p. 39.
1. Ptilodictya dubia. James, Paleontologist, No. 5, p. 40.

Cincinnati (Utica): Cincinnati, Ohio, and vicinity.

pora simplex Ulrich.

6. Arthropora simplex. Ulrich, Fourteenth Ann. Rep. Geol. Nat. Hist. Surv. Minnesota, p. 65.
3. Arthropora simplex. Ulrich, Geol. Minnesota, III, p. 177, pl. xiv, 12–21.

Trenton (Stones River and Black River): Minneapolis, St. Paul, and Fountain, Minnesota; Decorah, Iowa.

ROSTYLUS Ulrich. Genotype: Helopora tenuis James.

2. Arthronema (preoccupied). Ulrich, Jour. Cincinnati Soc. Nat. Hist., V, pp. 151, 160.
8. Arthrostylus. Ulrich, American Geologist, I, p. 230.
9. Arthrostylus. Miller, North American Geol. Pal., p. 293.
0. Arthrostylus. Ulrich, Jour. Cincinnati Soc. Nat. Hist., XII, p. 188.
0. Arthrostylus. Ulrich, Geol. Surv. Illinois, VIII, p. 400.
3. Arthrostylus. Ulrich, Geol. Minnesota, III, p. 187.
6. Arthrostylus. Ulrich, Zittel's Textb. Pal. (Engl. ed.), p. 280.
7. Arthrostylus. Simpson, Fourteenth Ann. Rep. State Geologist New York for the year 1894, p. 527.

stylus conjunctus Ulrich.

0. Arthrostylus conjunctus. Ulrich, Jour. Cincinnati Soc. Nat. Hist., XII, p. 189, fig. 14.
3. Arthrostylus conjunctus. Ulrich, Geol. Minnesota, III, p. 188, pl. iii, 13, 14.
7. Arthrostylus conjunctus. Simpson, Fourteenth Ann. Rep. State Geologist New York for the year 1894, figs. 78, 79, 79*a* (p. 526).

Trenton (Black River): Fountain, Minnesota.

stylus curtus (Ulrich).

2. Arthronema curtum. Ulrich, Jour. Cincinnati Soc. Nat. Hist., V, p. 161, pl. vi, 9.
9. Arthrostylus curtus. Miller, North American Geol. Pal., p. 293.

Cincinnati (Utica): Covington, Kentucky.

Obs. This may be a basal segment of some species of Arthropora.

Arthrostylus obliquus Ulrich.
1890. Arthrostylus obliquus. Ulrich, Jour. Cincinnati Soc. Na
p. 190, figs. 14*c*, *d*.
1893. Arthrostylus obliquus. Ulrich, Geol. Minnesota, III, p. 188,
Trenton (Stones River): Minneapolis, Minnesota.

Arthrostylus tenuis (James).
1878. Helopora tenuis. James, Paleontologist No. 1, p. 3.
1882. Arthronema tenuis. Ulrich, Jour. Cincinnati Soc. Nat. H
pl. vi, 8–8*c*.
1893. Arthrostylus tenuis. Ulrich, Geol. Minnesota, III, pl. iii, 16
Trenton: Covington, Kentucky.
Cincinnati (Utica): Covington and Newport, Kentucky; Ci

ASCODICTYON Nicholson and Etheridge, Jun. Genotype:
stellatum Nicholson and Etheridge, Jun.
1877. Ascodictyon. Nicholson and Etheridge, Jun., Ann. Mag.
4, XIX, p. 463.
1882. Ascodictyon. Vine, Quar. Jour. Geol. Soc. London, XXX
1889. Ascodictyon. Miller, North American Geol. Pal., p. 293.
1890. Ascodictyon. Ulrich, Geol. Surv. Illinois, VIII, p. 367.
1897. Ascodictyon. Simpson, Fourteenth Ann. Rep. State Geolo
for the year 1894, p. 603.
Obs. Ascodictyon fusiforme was the first species described
from the generic description, the authors intended A. stell
genotype.

Ascodictyon fusiforme Nicholson and Etheridge, Jun.
1877. Ascodictyon fusiforme, Nicholson and Etheridge, Jun., A
Hist., ser. 4, XIX, p. 463, pl. xix, 7, 8.
Hamilton: Widder, Ontario; Alpena, Michigan.

Ascodictyon stellatum Nicholson and Etheridge, Jun.
1877. Ascodictyon stellatum. Nicholson and Etheridge, Jun., A
Hist., ser. 4, XIX, p. 464, pl. xix, 1–6.
1881. Ascodictyon stellatum. Vine, Quar. Jour. Geol. Soc. Lond
p. 618.
1891. Ascodictyon stellatum. Whiteaves, Contr. Canadian Pal.,
1893. Ascodictyon stellatum. Ulrich, Geol. Minnesota, III, p. 11
1897. Ascodictyon stellatum. Simpson, Fourteenth Ann. Rep. S
New York for the year 1894, fig. 220 (p. 603).
Hamilton: Widder, Ontario; Eighteenmile Creek, New Yo

ASPIDOPORA Ulrich. Genotype: Aspidopora areolata U
1882. Aspidopora. Ulrich, Jour. Cincinnati Soc. Nat. Hist., V, p.
1889. Aspidopora. Miller, North American Geol. Pal., p. 293.
1890. Aspidopora. Ulrich, Geol. Surv. Illinois, VIII, p. 373.
1893. Aspidopora. Ulrich, Geol. Minnesota, III, p. 254.
1897. Aspidopora. Simpson, Fourteenth Ann. Rep. State Geolog
for the year 1894, p. 584.

Aspidopora areolata Ulrich.
1883. Aspidopora areolata. Ulrich, Jour. Cincinnati Soc. Nat. Hi
pl. vii, 2–2*c*.
1894. Monticulipora areolata. J. F. James, Jour. Cincinnati S
XVI, p. 183.
Cincinnati (Utica): Cincinnati, Ohio.

pora calycula (James).

1. Lichenalia? calycula. James, Catal. Foss. Cincinnati Group. (Not defined.)

5. Chætetes? calyculus. James, Introd. Catal. Foss. Cincinnati Group, p. 1.

1. Monticulipora (Diplotrypa) calycula. Nicholson, Genus Monticulipora, p. 165, pl. iv, 4–4*b*.

3. Prasopora calycula. Ulrich, Jour. Cincinnati Soc. Nat. Hist., VI, p. 165.

3. Monticulipora calycula. James and James, Jour. Cincinnati Soc. Nat. Hist., X, p. 167.

4. Monticulipora calycula. J. F. James, Jour. Cincinnati Soc. Nat. Hist., XVI, p. 184.

Trenton: Covington, Kentucky.

pora eccentrica (James).

2. Monticulipora (Heterotrypa?) eccentrica. James, Paleontologist, No. 6, p. 48; ibid., No. 7, pl. i, 6, 6*a*.

3. Monticulipora eccentrica. James and James, Jour. Cincinnati Soc. Nat. Hist., X, p. 167, pl. ii, 2*a*–*c*.

3. Aspidopora eccentrica. Ulrich, Geol. Minnesota, III, p. 255.

4. Monticulipora eccentrica. J. F. James, Jour. Cincinnati Soc. Nat. Hist., XVI. p. 185.

Cincinnati (Utica): Cincinnati, Ohio, and vicinity.

pora elegantula (Ulrich).

3. Aspidopora elegantula. Ulrich, Geol. Minnesota, III, p. 256, pl. xvii, 13–21.

7. Aspidopora elegantula. Simpson, Fourteenth Ann. Rep. State Geologist New York for the year 1894, figs. 162–164 (p. 584).

Trenton: Kenyon and St. Paul, Minnesota.

pora newberryi (Nicholson).

5. Chætetes Newberryi. Nicholson, Pal. Ohio, II, p. 212, pl. xxii, 4, 4*a*.

. Monticulipora (Prasopora) Newberryi. Nicholson, Genus Monticulipora, p. 212, pl. iv, 1–1*e*.

3. Prasopora ? newberryi. Ulrich, Jour. Cincinnati Soc. Nat. Hist., VI, p. 165.

6. Aspidopora newberryi. Ulrich, Fourteenth Ann. Rep. Geol. Nat. Hist. Surv. Minnesota, p. 91.

3. Monticulipora newberryi. James and James, Jour. Cincinnati Soc. Nat. Hist., X, p. 164.

4. Monticulipora newberryi. J. F. James, Jour. Cincinnati Soc. Nat. Hist., XVI, p. 179.

Cincinnati (Utica): Cincinnati, Ohio, and vicinity.

pora parasitica (Ulrich).

3. Aspidopora parasitica (in part). Ulrich, Fourteenth Ann. Rep. Geol. Nat. Hist. Surv. Minnesota, p. 90.

3. Aspidopora parasitica. Ulrich, Geol. Minnesota, III, p. 255, pl. xvii, 26–32.

4. Aspidopora parasitica. J. F. James, Jour. Cincinnati Soc. Nat. Hist., XVI, p. 180.

Trenton (Stones River and Black River): Minneapolis, St. Paul, and Fountain, Minnesota.

pora parmula (Foerste).

7. Prasopora parmula. Foerste, Bull. Sci. Lab. Denison Univ., II, p. 170; ibid., III, 1888, pl. xv, 14.

5. Aspidopora parmula. Foerste, Geol. Surv. Ohio, VII, p. 600, pl. xxviii, 14.

Clinton: Dayton and Clinton County, Ohio.

Aspidopora parmula-fenestelliformis Foerste.

1895. Aspidopora parmula var. fenestelliformis. Foerste, Geol. Surv. O
VII, p. 600.
Clinton: Dayton, Ohio.

Astroporites Lambe. Genotype: Astroporites ottawaensis Lambe.

1896. Astroporites. Lambe, Canadian Record of Science, VII, p. 1.
Obs.—This genus is founded upon the basal plate of a Lichenocrin
Mr. Ulrich, who pointed out this fact to us, has specimens which cle
indicate the nature of this fossil.

Astroporites ottawaensis Lambe. Not a bryozoan.

1896. Astroporites Ottawaensis. Lambe, Canadian Record of Science, VII,
pl. i, 1–3.
Trenton: Hull, near Ottawa, Canada.

ATACTOPORA Ulrich. Genotype: Atactopora hirsuta Ulrich.

1879. Atactopora (in part). Ulrich, Jour. Cincinnati Soc. Nat. Hist., II, p.
1882. Atactopora (in part). Ulrich, Jour. Cincinnati Soc. Nat. Hist., V, p.
1883. Atactopora. Ulrich, Jour. Cincinnati Soc. Nat. Hist., VI, p. 245.
1889. Atactopora. Miller, North American Geol. Pal., p. 293.
1890. Atactopora. Ulrich, Geol. Surv. Illinois, VIII, p. 377.
1896. Atactopora. Ulrich, Zittel's Textb. Pal. (Engl. ed.), p. 278.
1897. Atactopora. Simpson, Fourteenth Ann. Rep. State Geologist New Y
for the year 1894, p. 563.

Atactopora hirsuta Ulrich.

1879. Atactopora hirsuta. Ulrich, Jour. Cincinnati Soc. Nat. Hist., II, p. 120
xii, 3–3*b*.
1883. Atactopora hirsuta. Ulrich, Jour. Cincinnati Soc. Nat. Hist., VI, p. 245
xii, 1, 1*a*.
Cincinnati (Utica and Lorraine): Covington and Newport, Kentucky;
cinnati, Ohio.

Atactopora maculata Ulrich.

1879. Atactopora maculata. Ulrich, Jour. Cincinnati Soc. Nat. Hist., II, p.
pl. xii, 2–2*e*.
1883. Atactopora maculata. Ulrich, Jour. Cincinnati Soc. Nat. Hist., VI., p.
pl. xii, 2, 2*a*.
1896. Atactopora maculata. Ulrich, Zittel's Textb. Pal. (Engl. ed.), fig.
(p. 278).
Cincinnati (Lorraine): Cincinnati, Ohio, and vicinity.

Atactopora multigranosa Ulrich. See Atactoporella multigran
(Ulrich).

Atactopora mundula Ulrich. See Atactoporella mundula (Ulrich).

Atactopora septosa Ulrich. See Amplexopora septosa (Ulrich).

Atactopora subramosa Ulrich. See Heterotrypa subramosa (Ulric

Atactopora tenella Ulrich. See Atactoporella tenella (Ulrich).

ATACTOPORELLA Ulrich. Genotype: Atactoporella typicalis Ulri

1879. Atactopora (in part). Ulrich, Jour. Cincinnati Soc. Nat. Hist., II, p.
1881. Peronopora (in part). Nicholson, Genus Monticulipora, p. 215.
1883. Atactoporella. Ulrich, Jour. Cincinnati Soc. Nat. Hist., VI, p. 247.
1889. Atactoporella. Miller, North American Geol. Pal., p. 293.
1890. Atactoporella. Ulrich, Geol. Surv. Illinois, VIII, p. 370.
1893. Atactoporella. Ulrich, Geol. Minnesota, III, p. 222.

OPORELLA Ulrich—Continued.

. Atactoporella. Ulrich, Zittel's Textb. Pal. (Engl. ed,), p. 272.

. Atactoporella. Simpson, Fourteenth Ann. Rep. State Geologist New York for the year 1894, p. 585.

orella? crassa Ulrich.

. Atactoporella crassa. Ulrich, Geol. Minnesota, III, p. 225, pl. xv, 18–21.

Trenton: St. Paul and Cannon Falls, Minnesota.

orella insueta Ulrich.

. Atactoporella insueta. Ulrich, Geol. Minnesota, III, p. 224, pl. xv, 13–15, pl. xviii, 5–8.

Trenton (Black River): Minneapolis, St. Paul, and Fountain, Minnesota.

orella multigranosa (Ulrich).

. Atactopora multigranosa. Ulrich, Jour. Cincinnati Soc. Nat. Hist., II, p. 122, pl. xii, 1, 1*a*.

. Atactoporella multigranosa. Ulrich, Jour. Cincinnati Soc. Nat. Hist., VI, p. 254, pl. xii, 8, 8*a*.

. Atactoporella multigranosa. J. F. James, Jour. Cincinnati Soc. Nat. Hist., XVIII, p. 80.

Cincinnati (Lorraine): Hamilton, Morrow, and Cincinnati, Ohio.

orella mundula (Ulrich).

. Atactopora mundula. Ulrich, Jour. Cincinnati Soc. Nat. Hist., II, p. 123, pl. xii, 4, 4*a*.

. Atactoporella mundula. Ulrich, Jour. Cincinnati Soc. Nat. Hist., VI, p. 252, pl. xii, 6, 6*a*.

. Atactoporella mundula. J. F. James, Jour. Cincinnati Soc. Nat. Hist., XVIII, p. 80.

Cincinnati (Lorraine): Covington and Newport, Kentucky; Cincinnati, Ohio.

orella newportensis Ulrich.

. Atactoporella newportensis. Ulrich, Jour. Cincinnati Soc. Nat. Hist., VI, p. 250, pl. xii, 4–4b.

. Monticulipora newportensis. James and James, Jour. Cincinnati Soc. Nat. Hist., X, p. 183.

. Atactoporella newportensis. Miller, North American Geol. Pal., fig. 456 (p. 294).

. Monticulipora newportensis. J. F. James, Jour. Cincinnati Soc. Nat. Hist., XVI, p. 206.

Cincinnati (Utica): Newport, Kentucky.

orella ortoni (Nicholson).

. Chætetes Ortoni. Nicholson, Quar. Jour. Geol. Soc. London, XXX, p. 513, pl. xxix, 15–15*b*.

. Chætetes Ortoni. Nicholson, Pal. Ohio, II, p. 211, pl. xxii, 3–3*b*.

. Monticulipora (Peronopora?) Ortoni. Nicholson, Genus Monticulipora, p. 228, pl. iii, 4–4*d*.

. Atactoporella ortoni. Ulrich, Jour. Cincinnati Soc. Nat. Hist., VI, p. 256, pl. xii, 7, 7*a*.

. Monticulipora ortoni. James and James, Jour. Cincinnati Soc. Nat. Hist., XI, p. 22.

. Monticulipora ortoni. J. F. James, Jour. Cincinnati Soc. Nat. Hist., XVIII, p. 79.

Cincinnati (Lorraine): Cincinnati, Ohio, and vicinity.

Atactoporella ramosa Ulrich.

1893. Atactoporella ramosa. Ulrich, Geol. Minnesota, III, p. 226, pl. xx, 22–2

Trenton (Black River): Cannon Falls, Minnesota.

Atactoporella schucherti Ulrich.

1883. Atactoporella schucherti. Ulrich, Jour. Cincinnati Soc. Nat. Hist., p. 251, pl. xii, 5–5*b*.

1895. Atactoporella schucherti. J. F. James, Jour. Cincinnati Soc. Nat. H XVIII, p. 80.

Cincinnati (Richmond): Oxford, Waynesville, and Oregonia, Ohio; R mond and Versailles, Indiana.

Atactoporella tenella (Ulrich).

1879. Atactopora tenella. Ulrich, Jour. Cincinnati Soc. Nat. Hist., II, p. pl. xii, 5, 5*a*.

1883. Atactoporella tenella. Ulrich, Jour. Cincinnati Soc. Nat. Hist., VI, p.

1895. Atactoporella tenella. J. F. James, Jour. Cincinnati Soc. Nat. H XVIII, p. 80.

Cincinnati (Lorraine): Cincinnati, Ohio, and vicinity.

Atactoporella typicalis Ulrich.

1883. Atactoporella typicalis. Ulrich, Jour. Cincinnati Soc. Nat. Hist., p. 248, pl. xii, 3–3*d*.

1895. Atactoporella typicalis. J. F. James, Jour. Cincinnati Soc. Nat. H XVIII, p. 80.

1896. Atactoporella typicalis. Ulrich, Zittel's Textb. Pal. (Engl. ed.), fig. (p. 272).

1897. Atactoporella typicalis. Simpson, Fourteenth Ann. Rep. State Geolo New York for the year 1894, figs. 165–167 (p. 585).

Cincinnati (Utica): Covington and Newport, Kentucky; Cincinnati, O

Atactoporella typicalis-præcipta Ulrich.

1893. Atactoporella typicalis var. præcipta. Ulrich, Geol. Minnesota, III, p. pl. xv, 16, 17, pl. xviii, 1–4.

Trenton (Black River): Minneapolis, St. Paul, and Fountain, Minneso

Aulopora Goldfuss. Considered at present a genus of corals.

Aulopora arachnoidea Hall. See Stomatopora arachnoidea (Hall).

Aulopora ? Canadensis Nicholson. See Hederella canadensis (Ni olson).

Aulopora filiformis Billings. See Hederella filiformis (Billings).

Aulopora frondosa James. See Proboscina frondosa (Nicholson).

BACTROPORA Hall and Simpson. Genotype: Trematopora ? gr striata Hall.

1887. Bactropora. Hall and Simpson, Pal. New York, VI, p. xv.

1889. Bactropora. Miller, North American Geol. Pal., p. 294.

1890. Bactropora. Ulrich, Geol. Surv. Illinois, VIII, pp. 402, 662.

1896. Bactropora. Ulrich, Zittel's Texb. Pal., (Engl. ed.), p. 281.

1897. Bactropora. Simpson, Fourteenth Ann. Rep. State Geologist New Y for the year 1894, p. 553.

Bactropora curvata Hall and Simpson.

1887. Bactropora curvata. Hall and Simpson, Pal. New York, VI, p. 194, pl. 14–16.

1897. Bactropora curvata. Simpson, Fourteenth Ann. Rep. State Geologist York for the year 1894, pl. xvi, 13, 14.

Hamilton: Canandaigua Lake, New York.

opora granistriata (Hall).

83. Trematopora ? granistriata. Hall, Trans. Albany Institute, X, p. 182 (abstract, 1881, p. 182).

84. Trematopora ? granistriata. Hall, Rep. State Geologist New York for the year 1883, p. 13.

87. Bactropora granistriata. Hall and Simpson, Pal. New York, VI, p. 193, pl. lxvi, 20–22.

Hamilton: Darien Center, New York

opora simplex Ulrich.

90. Bactropora simplex. Ulrich, Geol. Surv. Illinois, VIII, p. 663, pl. lxx, 14–14*b*, pl. lxxi, 6, 6*a*.

94. Bactropora simplex. Keyes, Missouri Geol. Surv., V, p. 35.

Keokuk: Keokuk, Iowa; Nauvoo and Warsaw, Illinois; Clark County, Missouri.

STOMA Ulrich. Genotype: Monticulipora (Heterotrypa) implia Nicholson.

82. Batostoma. Ulrich, Jour. Cincinnati Soc. Nat. Hist., V, p. 154.

83. Batostoma. Foord, Contr. Micro-Pal. Cambro-Sil., p. 17.

89. Batostoma. Miller, North American Geol. Pal., p. 294.

90. Batostoma. Ulrich, Geol. Surv. Illinois, VIII, pp. 379, 459.

93. Batostoma. Ulrich, Geol. Minnesota, III, p. 288.

96. Batostoma. Ulrich, Zittel's Textb. Pal. (Engl. ed.), p. 275.

97. Batostoma. Simpson, Fourteenth Ann. Rep. State Geologist, New York, for the year 1894, p. 588.

toma canadense (Foord).

83. Amplexopora Canadensis. Foord, Contr. Micro-Pal. Cambro-Sil., p. 17, pl. iv, 2–2*d*.

93. Batostoma Canadensis. Ulrich, Geol. Minnesota, III, p. 317.

Trenton (Black River): St. Joseph Island, Lake Huron.

Trenton: Joliette, Quebec.

toma ? decipiens Ulrich.

93. Batostoma ? decipiens. Ulrich, Geol. Minnesota, III, p. 298, pl. xxvii, 16–19.

Trenton (Stones River and Black River): Minneapolis, Minnesota.

toma fertile Ulrich.

86. Batostoma fertilis. Ulrich, Fourteenth Ann. Rep. Geol. Nat. Hist. Surv. Minnesota, p. 92.

93. Batostoma fertile. Ulrich, Geol. Minnesota, III, p. 290, pl. xxv, 1–11.

96. Batostoma fertile. Ulrich, Zittel's Textb. Pal. (Engl. ed.), fig. 459 A (p. 275).

Trenton (Stones River): Minneapolis and St. Paul, Minnesota.

toma fertile-circulare Ulrich.

93. Batostoma fertile var. circulare. Ulrich, Geol. Minnesota, III, p. 291, pl. xxv, 8, 9.

96. Batostoma fertile. Ulrich, Zittel's Textb. Pal. (Engl. ed.), fig. 459 B (p. 275).

Trenton (Stones River): Minneapolis and St. Paul, Minnesota.

toma humile Ulrich.

93. Batostoma humile. Ulrich, Geol. Minnesota, III, p. 294, pl. xxv, 29–36.

Trenton: St. Paul and Cannon Falls, Minnesota; Decorah, Iowa.

Batostoma imperfectum Ulrich. See Hemiphragma imp
(Ulrich).

Batostoma implicatum (Nicholson).

1880. Chætetes implicata. Ulrich, Catal. Foss. Cincinnati Group, p
defined.)
1881. Monticulipora (Heterotrypa) implicata. Nicholson, Genus Mo
p. 147, pl. ii, 7–7*e*.
1882. Batostoma implicatum. Ulrich, Jour. Cincinnati Soc. Nat. Hist
1894. Monticulipora implicatum. J. F. James, Jour. Cincinnati Soc.
XVI, p. 198.
1875. Alecto nexilis. James, Intr. Catal. Foss. Cincinnati Group, p.
1878. Ceramopora ? irregularis, James, Paleontologist, No. 1, p. 5.
Cincinnati (Utica): Cincinnati, Ohio, and vicinity.
Obs. Alecto nexilis James was founded upon specimens of t
showing the large perforated acanthopores which Mr. James
the cell apertures of his species.

Batostoma irrasa Ulrich. See Hemiphragma irrasum (Ulric

Batostoma jamesi (Nicholson).

1874. Chætetes Jamesi. Nicholson, Quar. Jour. Geol. Soc. London
506, pl. xxix, 10–10*b*.
1875. Chætetes Jamesi. Nicholson, Pal. Ohio, II, p. 200, pl. xxi, 11
1876. Chætetes Jamesi. Nicholson, Ann. Mag. Nat. Hist., ser. 4, X
pl. v, 5.
1880. Monticulipora Jamesi. Nicholson, Ann. Mag. Nat. Hist., ser. 5,
fig. 3A, B, fig. 4.
1881. Monticulipora (Heterotrypa) Jamesi. Nicholson, Genus Mo
p. 143, figs. 25, 26.
1882. Batostoma jamesi. Ulrich, Jour. Cincinnati Soc. Nat. Hist.,
ibid., VI, 1883, p. 83.
1883. Monticulipora Jamesi. (Van Cleve), Hall, Twelfth Ann. Re
Geol. Nat. Hist., p. 248, pl. xi, 8.
1888. Monticulipora jamesi. James and James, Jour. Cincinnati Soc.
X, p. 176.
1889. Batostoma jamesi. Miller, North American Geol. Pal., fig. 4
1894. Monticulipora jamesi. J. F. James, Jour. Cincinnati Soc. Nat.
p. 197.
Cincinnati (Utica): Cincinnati, Ohio, and vicinity.

Batostoma magnoporum Ulrich.

1893. Batostoma magnopora. Ulrich, Geol. Minnesota, III, p. 29
12–15.
Trenton (Black River): Minneapolis and St. Paul, Minnesota.

Batostoma manitobense Ulrich.

1889. Batostoma Manitobense. Ulrich, Contr. Micro-Pal. Cambro-S
p. 33, pl. ix, 3–3*c*.
1895. Batostoma Manitobense. Whiteaves, Paleozoic Foss., III, p.
Cincinnati (Richmond): Stony Mountain, Manitoba.

Batostoma minnesotense Ulrich.

1886. Amplexopora superba (not of Foord). Ulrich, Fourteenth
Geol. Nat. Hist. Surv. Minnesota, p. 92.
1893. Batostoma minnesotense. Ulrich, Geol. Minnesota, III, p. 29
38–40, pl. xxvii, 9–15.

toma minnesotense Ulrich—Continued.

97. Batostoma Minnesotense. Simpson, Fourteenth Ann. Rep. State Geologist New York for the year 1894, fig. 173 (p. 588).
Trenton (Black River): Minneapolis and St. Paul, Minnesota.

toma montuosum Ulrich.

93. Batostoma montuosum. Ulrich, Geol. Minnesota, III, p. 293, pl. xxv, 26–28.
Trenton (Black River): Cannon Falls, Minnesota.

stoma Ottawaense Foord. See Hemiphragma ottawense (Foord).

toma ? rugosum (Whitfield).

80. Fistulipora rugosa. Whitfield, Ann. Rep. Wisconsin Geol. Surv. for the year 1879, p. 60.
82. Fistulipora rugosa. Whitfield, Geol. Surv. Wisconsin, IV, p. 255, pl. xi, 20, 21.
89. Batostoma rugosum. Miller, North American Geol. Pal., p. 294.
Cincinnati (Richmond): Delafield, Wisconsin.

toma superbum (Foord).

83. Amplexopora superba. Foord, Contr. Micro-Pal. Cambro-Sil., p. 16, pl. iv, 1–1*c*.
93. Batostoma superbum. Ulrich, Geol. Minnesota, III, p. 297.
Trenton: Montreal, Canada.

stoma variabile Ulrich. See Batostoma varians (James).

toma varians (James).

78. Chætetes varians. James, Paleontologist, No. 1, p. 2.
81. Monticulipora (Chætetes) varians. James, Paleontologist, No. 5, p. 36.
88. Monticulipora varians. James and James, Jour. Cincinnati Soc. Nat. Hist., X, p. 177, pl. ii, 4 *a*, *b*.
94. Monticulipora varians. J. F. James, Jour. Cincinnati Soc. Nat. Hist., XVI, p. 199.
90. Batostoma variabile. Ulrich, Geol. Surv. Illinois, VIII, p. 460, pl. xxxv, 4–4*e*, 5 (not 5*a*), pl. xxxvi, 1.
94. Batostoma variabile. J. F. James, Jour. Cincinnati Soc. Nat. Hist., XVI, p. 200.
Cincinnati (Richmond): Blanchester, Clarksville, and other localities in Ohio; Richmond and Versailles, Indiana; Savannah, Illinois; Delafield, Wisconsin.

toma varium Ulrich.

93. Batostoma varium. Ulrich, Geol. Minnesota, III, p. 292, pl. xxv, 16–25.
97. Batostoma varium. Simpson, Fourteenth Ann. Rep. State Geologist New York for the year 1894, fig. 175 (p. 588) (not fig. 176=Eridotrypa mutabilis Ulrich).
Trenton (Black River): Minneapolis and St. Paul, Minnesota.

toma winchelli (Ulrich).

86. Amplexopora winchelli. Ulrich, Fourteenth Ann. Rep. Geol. Nat. Hist. Surv. Minnesota, p. 91.
93. Batostoma winchelli. Ulrich, Geol. Minnesota, III, p. 295, pl. xxvi, 33–37, pl. xxvii, 1–6.
97. Batostoma Winchelli, Simpson, Fourteenth Ann. Rep. State Geologist New York for the year 1894, fig. 174 (p. 588).
Trenton (Black River): St. Paul and Minneapolis, Minnesota: Goodhue and Fillmore counties, Minnesota.

Batostoma winchelli-nodosum Ulrich.

1893. Batostoma winchelli var. nodosa. Ulrich, Geol. Minnesota, III, p. pl. xxvi, 35.

Trenton (Black River): Minneapolis and St. Paul, Minnesota.

Batostoma winchelli-spinulosum Ulrich.

1893. Batostoma winchelli var. spinulosum. Ulrich, Geol. Minnesota, II 296, pl. xxvii, 7, 8.

1896. Batostoma winchelli var. spinulosum. Ulrich, Zittel's Textb. Pal. (ed.), fig. 459 C (p. 275).

Trenton (Black River): Minneapolis and St. Paul, Minnesota.

BATOSTOMELLA Ulrich. Genotype: Batostomella spinulosa Ulr

1882. Batostomella (in part). Ulrich, Jour. Cincinnati Soc. Nat. Hist., V 141, 154.

1889. Batostomella. Miller, North American Geol. Pal., p. 294.

1890. Batostomella (in part). Ulrich, Geol. Surv. Illinois, VIII, pp. 375,

1895. Batostomella. Whidborne, Devon. Fauna England (Pal. Soc. Publ. pt. 4, p. 187.

1896. Batostomella. Ulrich, Zittel's Textb. Pal. (Engl. ed.), p. 277.

1886. Geinitzella. Waagen and Wentzel, Pal. Indica, Ser. XIII, pp. 875,

1896. Geinitzella. Zittel, Textb. Pal. (Engl. ed.), p. 105.

Batostomella abrupta Ulrich.

1890. Batostomella abrupta. Ulrich, Geol. Surv. Illinois, VIII, p. 435, pl. l 2–2*e*.

Chester: Sloans Valley, Kentucky.

Batostomella annulata Ulrich. See Trematella annulata (Hall).

Batostomella annulifera Ulrich. See Lioclemella annulifera (W field).

Batostomella ? aspera (Hall).

1852. Trematopora aspera. Hall, Pal. New York, II, p. 154, pl. xl A, 10*a*-

Niagara: Lockport, New York.

Batostomella gracilis Ulrich. See Bythopora gracilis (Nicholson).

Batostomella granulifera (Hall).

1852. Trematopora granulifera. Hall, Pal. New York, II, p. 154, pl. xl A, 9*a*-

*1876. Trematopora granulifera. Hall, Twenty-eighth Ann. Rep. New State Museum (documentary edition), pl. xi, 6, 7; ibid. (Museum tion, 1879), p. 112, pl. xi, 6, 7.

*1882. Trematopora granulifera. Hall, Eleventh Ann. Rep. Indiana Geol. Hist., p. 233, pl. x, 6, 7.

1890. Rhombopora granulifera. Ulrich, Geol. Surv. Illinois, VIII, p. 647.

Niagara: Lockport, New York; Waldron, Indiana.

Obs. The citations preceded by the (*) refer to the Waldron form, may be specifically distinct.

Batostomella granulifera Ulrich. See Homotrypella granuli (Ulrich).

Batostomella interstincta Ulrich.

1890. Batostomella interstincta. Ulrich, Geol. Surv. Illinois, VII, p. 43 lxxv, 4–4*e*.

Ste. Genevieve: Pella, Iowa.

mella nitidula Ulrich.

0. Batostomella nitidula. Ulrich, Geol. Surv. Illinois, VIII, p. 436, pl. lxxv. 3–3*b*.

4. Batostomella nitidula. Keyes, Missouri Geol. Surv., V, p. 14.
Chester: Chester, Illinois; Sloans Valley, Kentucky.

omella obliqua Ulrich. See Eridotrypa ? obliqua (Ulrich).

omella perspinulata Ulrich. See Trematella perspinulata (Hall).

omella simulatrix Ulrich. See Eridotrypa simulatrix (Ulrich).

mella spinulosa Ulrich.

0. Batostomella spinulosa. Ulrich, Geol. Surv. Illinois, VIII, p. 434, pl. lxxv, 1–1*f*.

6. Batostomella spinulosa. Ulrich, Zittel's Textb. Pal. (Engl. ed.), fig. 463 (p. 277).
Chester: Sloans Valley, Kentucky; Chester, Illinois.

NICEA Lamouroux. Genotype: Berenicea diluviana Lamouroux.

1. Berenicea (in part). Lamouroux, Expos. Meth. des Genres d. Pol., p. 80

2. Berenicea. McCoy, Brit. Pal. Foss., p. 44.

4. Berenicea. D'Orbigny, Pal. Franc. Terr. Cret., V, p. 858.

4. Berenicea. Haime, Bry. de la Form. Juras., p. 175.

2. Berenicea. Ulrich, Jour. Cincinnati Soc. Nat. Hist., V, p. 149.

9. Berenicea. Miller, North American Geol. Pal., p. 294.

0. Berenicea. Ulrich, Geol. Surv. Illinois, VIII, p. 368.

3. Berenicea. Ulrich, Geol. Minnesota, III, p. 120.

6. Berenicea. Ulrich, Zittel's Textb. Pal. (Engl. ed.), p. 261.

7. Berenicea. Simpson, Fourteenth Ann. Rep. State Geologist New York for the year 1894, p. 594.

0. Rosacilla. F. A. Roemer, Verst. des Norddeutsh. Kreidegeb., p. 19.

Diastopora (not of Lamouroux). D'Orbigny, Busk, and other English authors.

Diastopora (in part). Hincks, Vine, and other authors.

2. Sagenella. Hall, Pal. New York, II, p. 172.

9. Sagenella. Miller, North American Geol. Pal., p. 321.

7. Sagenella. Simpson, Fourteenth Ann. Rept. State Geologist New York for the year 1894, p. 597.

3. Diastoporella. Vine, Rep. British Ass. Adv. Sci., LII, p. 275.

7. Diastoporella. Vine, Proc. Yorkshire Geol. Polyt. Soc., IX, p. 190.

cea elegans (Hall).

6. Sagenella elegans. Hall, Twenty-eighth Ann. Rep. New York State Museum (documentary edition), pl. vii, 12, 13; ibid. (Museum edition, 1879), p. 118, pl. vii, 12, 13.

2. Sagenella elegans. Hall, Eleventh Ann. Rep. Indiana Geol. Nat. Hist., p. 242, pl. vi, 12, 13.

7. Sagenella elegans. Simpson, Fourteenth Ann. Rep. State Geologist New York for the year 1894, pl. xx, 4.
Niagara: Waldron, Indiana.

cea ? insueta Dawson.

3. Berenicea insueta. Dawson, Rep. on Peter Redpath Museum, No. 2, p. 12.
Subcarboniferous: Windsor, Nova Scotia.

cea membranacea (Hall).

2. Sagenella membranacea. Hall, Pal. New York, II, p. 172, pl. xlE, 6 *a*, *b*.
Niagara: Lockport and Rochester, New York.

Berenicea minnesotensis Ulrich.

1886. Berenicea minnesotensis. Ulrich, Fourteenth Ann. Rep. G Surv. Minnesota, p. 58.
1893. Berenicea minnesotensis. Ulrich, Geol. Minnesota, III, p. 1 29, pl. ii, 1.
1897. Berenicea Minnesotensis. Simpson, Fourteenth Ann. Rep. S New York for the year 1894, figs. 197, 198 (p. 595).
Trenton (Stones River and Black River): Minneapolis Minnesota.

Berenicea primitiva Ulrich.

1882. Berenicea primitiva. Ulrich, Jour. Cincinnati Soc. Nat. H pl. vi, 4.
Cincinnati (Lorraine and Richmond): Cincinnati, Waynesv Clarksville, and other localities in Ohio; Richmond a Indiana.

Berenicea vesiculosa Ulrich.

1882. Berenicea vesiculosa. Ulrich, Jour. Cincinnati Soc. Nat. H pl. vi, 5.
Cincinnati (Utica): Cincinnati, Ohio, and vicinity.

BOTRYLLOPORA Nicholson. Genotype: Botryllopora soci son.

1874. Botryllopora. Nicholson, Canad. Jour., XIV, p. 133.
1874. Botryllopora. Nicholson, Geol. Mag., new ser., I, p. 159.
1874. Botryllopora. Nicholson, Pal. Province Ontario, p. 96.
1887. Botryllopora. Hall and Simpson, Pal. New York, VI, p. xx
1889. Botryllopora. Miller, North American Geol. Pal., p. 294.
1890. Botryllopora. Ulrich, Geol. Surv. Illinois, VIII, p. 384.
1897. Botryllopora. Simpson, Fourteenth Ann. Rep. State Geolog for the year 1894, p. 592.
1899. Botryllopora. Grabau, Bull. Buffalo Soc. Nat. Sci., VI, p. 17

Botryllopora socialis Nicholson.

1874. Botryllopora socialis. Nicholson, Geol. Mag., new ser., I, p.
1874. Botryllopora socialis. Nicholson, Pal. Province Ontario, p. 9
1884. Botryllopora socialis. Hall, Rep. State Geologist New Yor 1883, p. 61.
1887. Botryllopora socialis. Hall and Simpson, Pal. New York, lxiv, 3, 4.
1889. Botryllopora socialis. Miller, North American Geol. Pal., fi
1890. Botryllopora socialis. Ulrich, Geol. Surv. Illinois, VIII, p. 9–9 *b*.
1897. Botryllopora socialis. Simpson, Fourteenth Ann. Rep. St New York for the year 1894, pl. xx, 16, 17.
1899. Botryllopora socialis. Grabau, Bull. Buffalo Soc. Nat. Sci., V
Hamilton: Arkona and West Williams, Ontario, Canada; Creek, New York; near Alpena, Michigan; Falls of the O
Obs. See also Fistulipora helios Rominger.

BUSKOPORA Ulrich. Genotype: Buskopora dentata Ulri

1886. Buscopora. Ulrich, Contr. American Pal., I, p. 22.
1889. Buscopora. Miller, North American Geol. Pal., p. 295.
1890. Buskopora. Ulrich, Geol. Surv. Illinois, VIII, p. 383.
1896. Buskopora. Ulrich, Zittel's Textb. Pal. (Engl. ed.), p. 270

KOPORA Ulrich—Continued.

386. Odontotrypa. Hall, Rep. State Geologist New York for the year 1885, explanation sheet, pl. xxx.

387. Odontotrypa. Hall and Simpson, Pal. New York, VI, pl. xvii.

389. Odontotrypa. Miller, North American Geol. Pal., p. 313.

397. Odontotrypa. Simpson, Fourteenth Ann. Rep. State Geologist New York for the year 1894, p. 561.

Obs. See also remarks under Glossotrypa Hall.

opora bistriata (Hall).

383. Lichenalia bistriata. Hall, Trans. Albany Institute, X, p. 150 (abstract, 1881, p. 8).

386. Lichenalia bistriata. Hall, Fifth Ann. Rep. State Geologist New York for the year 1885, pl. xxxii, 6–14.

387. Lichenalia bistriata. Hall and Simpson, Pal. New York, VI, p. 79, pl. xxxii, 6–14.

397. Pileotrypa bistriata. Simpson, Fourteenth Ann. Rep. State Geologist New York for the year 1894, pl. xxiii, 14.

383. Lichenalia alveata. Hall, Trans. Albany Institute, X, p. 152 (abstract, 1881, p. 10).

386. Lichenalia (Odontotrypa) alveata. Hall, Fifth Ann. Rep. State Geologist New York for the year 1885, pl. xxx, 24–27.

387. Lichenalia (Odontotrypa) alveata. Hall and Simpson, Pal. New York, VI, p. 85, pl. xxx, 24–27.

397. Odontotrypa alveata. Simpson, Fourteenth Ann. Rep. State Geologist New York for the year 1894, pl. xxiv, 1–3.

Hamilton: Falls of the Ohio.

opora dentata Ulrich.

386. Buscopora dentata. Ulrich, Contr. American Pal., I, p. 22, pl. ii, 5, 5*a*.

96. Buskopora dentata. Ulrich, Zittel's Textb. Pal. (Engl. ed.), fig. 446 (p. 270).

83. Lichenalia lunata n. sp. (not Rominger's). Hall, Trans. Albany Institute, X, p. 152 (abstract, 1881, p. 10).

86. Lichenalia lunata. Hall, Fifth Ann. Rep. State Geologist New York for the year 1885, pl. xxxi, 1–9.

87. Lichenalia lunata. Hall and Simpson, Pal. New York, VI, p. 77, pl. xxxi, 1–9.

97. Lichenalia lunata. Simpson, Fourteenth Ann. Rep. State Geologist New York for the year 1894, pl. xxiii, 5, 6.

89. Buskopora lunata. Miller, North American Geol. Pal., fig. 460 (p. 295).

90. Buskopora lunata. Ulrich, Geol. Surv. Illinois, VIII, p. 489, pl. xlviii, 7–7*d*.

86. Lichenalia lunata var. tubulata. Hall, Fifth Ann. Rep. State Geologist New York for the year 1885, pl. xxxi, 28, 29.

87. Lichenalia lunata var. tubulata. Hall and Simpson, Pal. New York, VI, p. 78, pl. xxxi, 28, 29.

89. Buscopora lunata var. tubulata. Miller, North American Geol. Pal., p.295.

Hamilton: Falls of the Ohio.

Obs. Both Hall and Ulrich (in part) have regarded their species as synonyms for Rominger's Fistulipora lunata. It is very doubtful whether these forms are specifically the same as Rominger's; until such relationship is proved, we prefer to keep them distinct. But Hall's Lichenalia lunata and Ulrich's Buskopora dentata are the same form; as Hall's name is the same as Rominger's, it should be dropped in favor of Ulrich's name.

Buskopora lunata (Rominger).

1866. Fistulipora lunata. Rominger, Proc. Acad. Nat. Sci. Philadelphia, p. 1
Upper Helderberg: Sandusky and Columbus, Ohio.

Buskopora lunata Ulrich. See Buskopora dentata Ulrich.

Buskopora lunata var. tubulata Miller. See Buskopora dentata Ulri

Buskopora pyriformis (Hall).

1883. Lichenalia pyriformis. Hall, Trans. Albany Institute, X, p. 154 (abstr 1881, p. 12).
1886. Lichenalia (Pileotrypa) pyriformis. Hall, Fifth Ann. Rep. State Geolo New York for the year 1885, pl. xxxi, 21–27.
1887. Lichenalia (Pileotrypa) pyriformis. Hall and Simpson, Pal. New Yo VI, p. 82, pl. xxxi, 21–27.
1897. Pileotrypa pyriformis. Simpson, Fourteenth Ann. Rep. State Geolo New York for the year 1894, pl. xxiii, 9–11.
Hamilton: Falls of the Ohio.

BYTHOPORA Miller and Dyer. Genotype: Bythopora fruticosa Mil and Dyer = Helopora dendrina James.

1878. Bythopora. Miller and Dyer, Contr. to Pal., No. 2, p. 6.
1889. Bythopora. Miller, North American Geol. Pal., p. 295.
1890. Bythopora. Ulrich, Geol. Surv. Illinois, VIII, p. 376.
1893. Bythopora. Ulrich, Geol. Minnesota, III, p. 263.
1896. Bythopora. Ulrich, Zittel's Textb. Pal. (Engl. ed.), p. 277.
1897. Bythopora. Simpson, Fourteenth Ann. Rep. State Geologist New Y for the year 1894, p. 551.

Bythopora alcicornis Ulrich.

1893. Bythopora alcicornis. Ulrich, Geol. Minnesota, III, p. 264, pl. xxvi,
1897. Bythopora alcicornis. Simpson, Fourteenth Ann. Rep. State Geolo New York for the year 1894, fig. 121 (p. 551).
Trenton (Black River): Cannon Falls, Minnesota.

Bythopora arctipora (Nicholson).

1875. Ptilodictya ? arctipora. Nicholson, Ann. Mag. Nat. Hist., ser. 4, XV, p. pl. xiv, 4–4*b*.
1875. Ptilodictya ? arctipora. Nicholson, Pal. Ohio, II, p. 262, pl. xxv, 9–9*b*.
1878. Bythopora arctipora. Miller and Dyer, Contr. to Pal., No. 2, p. 6.
Cincinnati (Utica): Cincinnati, Ohio, and vicinity.
Obs. See also Bythopora parvula (James).

Bythopora delicatula (Nicholson).

1874. Chætetes delicatulus. Nicholson, Quar. Jour. Geol. Soc. London, XX p. 505, pl. xxix, 8–8*b*.
1875. Chætetes delicatulus. Nicholson, Pal. Ohio, II, p. 199, pl. xxi, 9, 9*a*.
1875. Chætetes delicatulus. Nicholson, Pal. Province Ontario, p. 30.
1888. Monticulipora delicatula. James and James, Jour. Cincinnati Soc. Hist., X, p. 173.
1889. Bythopora ? delicatula. Ulrich, Contr. Micro-Pal. Cambro-Sil., Part p. 36.
1895. Bythopora delicatula. Whiteaves, Pal. Foss., III, p. 116.
1879. Chætetes minutus. James, Paleontologist, No. 3, p. 20. (See James James, Jour. Cincinnati Soc. Nat. Hist., X, p. 173.)
Cincinnati (Richmond): Oxford, Waynesville, Lebanon, and other loc ties in Ohio; Richmond and Versailles, Indiana; Weston and Toron Ontario, Canada; Stony Mountain, Manitoba, Canada.

Bythopora dendrina (James).

1878. Helopora dendrina. James, Paleontologist, No. 1, p. 3, (July 2, 1878); ibid., No. 2, p. 14.
1878. Bythopora fruticosa. Miller and Dyer, Contr. to Pal., No. 2, p. 6, pl. iv, 6, 6*a*, (July 22, 1878).
1889. Bythopora fruticosa. Miller, North American Geol. Pal., fig. 461 (p. 295).
Cincinnati (Lorraine): Cincinnati, Ohio, and vicinity.

Bythopora fruticosa Miller and Dyer. See Bythopora dendrina (James).

Bythopora gracilis (Nicholson).

1871. Chætetes gracilis. James, Catal. Low. Sil. Foss. Cincinnati Group, p. 3. (Not defined).
1874. Chætetes gracilis. Nicholson, Quar. Jour. Geol. Soc. London, XXX, p. 504, pl. xxix, 7, 7*a*.
1875. Chætetes gracilis. Nicholson, Pal. Ohio, II, p. 198, pl xxi, 8–8*b*.
1875. Chætetes gracilis. Nicholson, Pal. Province Ontario, p. 11. (Same species ?)
1876. Chætetes gracilis. Nicholson, Ann. Mag. Nat. Hist., ser. 4, XXVIII, p. 90, pl. v, 13.
1881. Monticulipora (Heterotrypa) gracilis. Nicholson, Genus Monticulipora, p. 125, pl. ii, 1–1*b* and fig. 20.
1882. Batostomella gracilis. Ulrich, Jour. Cincinnati Soc. Nat. Hist., V, p. 141; ibid., VI, 1883, p. 83.
1883. Monticulipora gracilis. (Van Cleve) Hall, Twelfth Ann. Rep. Indiana Geol. Nat. Hist., p. 248, pl. x, 1–3, pl. xi, 11.
1886. Batostomella gracilis. Ulrich, Fourteenth Ann. Rep. Geol. Nat. Hist. Surv. Minnesota, p. 103.
1888. Monticulipora gracilis. James and James, Jour. Cincinnati Soc. Nat. Hist., X, p. 173.
1889. Batostomella gracilis. Ulrich, Contr. Micro-Pal. Cambro-Sil., Part II, p. 35.
1889. Batostomella gracilis. Miller, North American Geol. Pal., fig. 458 (p. 294).
1890. Batostomella gracilis. Ulrich, Geol. Surv. Illinois, VIII, p. 432, pl. xxxv, 2.
1893. Homotrypella gracilis. Ulrich, Geol. Minnesota, III, p. 228.
1894. Monticulipora gracilis. J. F. James, Jour. Cincinnati Soc. Nat. Hist, XVI, p. 191.
1895. Homotrypella gracilis. Whiteaves, Pal. Foss., III, p. 115.
1881. Chætetes læviramus. Quenstedt, Roehren- und Sternkorallen, p. 81, pl. cxlvi, 2*b*.
Cincinnati (Lorraine): Cincinnati, Ohio, and vicinity.

Bythopora herricki (Ulrich).

1886. Bythopora herricki. Ulrich, Fourteenth Ann. Rep. Geol. Nat. Hist. Surv. Minnesota, p. 99.
1893. Bythopora herricki. Ulrich, Geol. Minnesota, III, p. 263, pl. xxvi, 1–6.
1897. Bythopora Herricki. Simpson, Fourteenth Ann. Rep. State Geologist New York for the year 1894, fig. 120 (p. 551).
Trenton (Black River): St. Paul and Minneapolis, Minnesota.

Bythopora meeki (James).

1878. Chætetes meeki. James, Paleontologist, No. 1, p. 1.
1881. Monticulipora (Chætetes) meeki. James, Paleontologist, No. 5, p. 35.
1881. Monticulipora gracilis var. meeki. Nicholson, Genus Monticulipora, p. 127.
1888. Monticulipora meeki. James and James, Jour. Cincinnati Soc. Nat. Hist., X, p. 174.
1893. Homotrypella meeki. Ulrich, Geol. Minnesota, III, p. 228.

Bythopora meeki (James)—Continued.

1894. Monticulipora meeki. J. F. James, Jour. Cincinnati Soc. Nat p. 192.

Cincinnati (Richmond): Waynesville, Oxford, Lebanon, and ties in Ohio; Richmond and Versailles, Indiana.

Bythopora nashvillensis Miller. See Rhinidictya nashvillens

Bythopora parvula (James).

1878. Helopora parvula. James, Paleontologist, No. 1, p. 3.

1878. Helopora approximata. James, Paleontologist, No. 1, p. 3.

Cincinnati (Utica): Obanon Creek, Clermont County, Ohio.

Obs. This form may not be distinct from Bythopora arctipora

Bythopora spinulosa (Hall).

1852. Trematopora spinulosa. Hall, Pal. New York, II, p. 155, pl

Niagara: Lockport, New York.

Bythopora striata Ulrich.

1889. Bythopora striata. Ulrich, Contr. Micro-Pal. Cambro-Sil., P

1895. Bythopora striata. Whiteaves, Pal. Foss., III, p. 116.

Cincinnati (Richmond): Stony Mountain, Manitoba; Mid many other localities in Ohio.

BYTHOTRYPA Ulrich. Genotype: Fistulipora ? laxata U

1893. Bythotrypa. Ulrich, Geol. Minnesota, III, p. 324.

1896. Bythotrypa. Ulrich, Zittel's Textb. Pal. (Engl. ed.), p. 268.

Bythotrypa epidermata (Ulrich).

1890. Crepipora epidermata. Ulrich, Geol. Surv. Illinois, VIII xl, 1–1*e*.

Cincinnati (Richmond): Wilmington and Savannah, Illinois

Bythotrypa laxata (Ulrich).

1889. Fistulipora? laxata. Ulrich, Contr. Micro-Pal. Cambro-Sil., pl. viii, 2, 2*a*.

1893. Bythotrypa laxata. Ulrich, Geol. Minnesota, III, p. 325, pl.

1896. Bythotrypa laxata. Ulrich, Zittel's Textb. Pal. (Engl. ed.), 268).

1897. Bythotrypa laxata. Whiteaves, Pal. Foss., III, Part III, p. 1

Trenton (Stones River, Black River, and Trenton): St. And toba; Minneapolis, St. Paul, Kenyon, Berne, and Cannon sota; Rockton, Illinois; Decorah, Iowa.

Callopora Dybowski (not Hall). See Diplotrypa Nicholson

CALLOPORA Hall. (Not Callopora Gray, 1848.)[1] Geno lopora elegantula Hall.

1852. Callopora. Hall, Pal. New York, II, p. 144.

1874. Callopora. Nicholson, Pal. Province Ontario, p. 61.

1874. Callopora. Nicholson, Geol. Mag. new ser., I, p. 13.

1879. Callopora. Hall, Twenty-eighth Ann. Rep. New York State

1882. Callopora. Ulrich, Jour. Cincinnati Soc. Nat. Hist., V, pp. 1

1887. Callopora. Foerste, Bull. Sci. Lab. Denison Univ., II, p. 172.

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[1] In 1848 Gray (Proc. Zool. Soc., London, Appendix, 1848, and List of British Animals tion of the British Museum, 1848, pp. 109, 146) proposed the generic term Callopora for a the Flustra lineata of Linnæus, but the term failed to gain acceptance, and the species considered to be a Membranipora. As Callopora Hall has become deeply engrafted in seems undesirable under the circumstances to replace it by a new name.

LOPORA Hall—Continued.

887. Callopora. Hall and Simpson, Pal. New York, VI, p. xv.
889. Callopora. Miller, North American Geol. Pal., p. 295.
890. Callopora. Ulrich, Geol. Surv. Illinois, VIII, pp. 372, 416.
893. Callopora. Ulrich, Geol. Minnesota, III, p. 275.
896. Callopora. Ulrich, Zittel's Textb. Pal. (Engl. Ed.), p. 275.
897. Callopora. Simpson, Fourteenth Ann. Rep. State Geologist New York for the year 1894, p. 588.
877. Monticulipora (Section 1). Dybowski, Die Chætetiden d. Ostb. Silur-Form., p. 89.

opora aculeolata Hall. See Cœlocaulis ? ? aculeolata (Hall).

opora (Cœlocaulis) aculeolata Hall. See Cœlocaulis ? ? aculeolata Iall).

pora ampla Ulrich.

893. Callopora ampla. Ulrich, Geol. Minnesota, III, p. 281, pl. xxiii, 13–15, 18–20, 22, 23, 27, 28.

Trenton (Black River and Trenton): Ramsey, Goodhue, and Fillmore counties, Minnesota; Decorah, Iowa; Belleville, Canada.

pora andrewsi (Nicholson).

874. Chætetes pulchellus (not of Milne-Edwards and Haime). Nicholson, Quar. Jour. Geol. Soc. London, XXX, p. 503, pl. xxix, 5–5*b*.
875. Chætetes pulchellus (not of Milne-Edwards and Haime). Nicholson, Pal. Ohio, II, p. 195, pl. xxi, 5, 5*a*.
881. Monticulipora (Heterotrypa) Andrewsii. Nicholson, Genus Monticulipora, p. 128, fig. 21, pl. v, 1, 1*a*.
882. Callopora andrewsi. Ulrich, Jour. Cincinnati Soc. Nat. Hist., V, p. 252.
883. Monticulipora andrewsii. (Van Cleve) Hall, Twelfth Ann. Rep. Indiana Geol. Nat. Hist., p. 249, pl. xi, 9.
888. Monticulipora andrewsii. James and James, Jour. Cincinnati Soc. Nat., Hist., X, p. 178.
894. Monticulipora andrewsii. J. F. James, Jour. Cincinnati Soc. Nat. Hist., XVI, p. 200.

Cincinnati (Lorraine): Cincinnati, Ohio and vicinity.

pora angularis Ulrich.

893. Callopora angularis. Ulrich, Geol. Minnesota, III, p. 277, pl. xxii, 37–41.

Trenton (Stones River): Minneapolis, Chatfield, and Fountain, Minnesota.

opora aspera Hall. See Lioclema asperum (Hall).

opora bipunctata Hall. See Streblotrypa hamiltonensis (Nicholson).

opora bispinulata Hall. See Orthopora bispinulata (Hall).

opora cellulosa Hall. See Lioclema cellulosum (Hall).

pora ? ? cervicornis Hall.

883. Callopora cervicornis. Hall, Trans. Albany Institute, X, p. 59 (abstract, 1879, p. 3).
882. Callopora cervicornis. Hall, Eleventh Ann. Rep. Indiana Geol. Nat. Hist., p. 238.

Niagara; Waldron, Ind.

Obs. It is doubtful whether this species can be recognized in the absence of figures, from the rather inadequate description.

opora cincinnatiensis Ulrich. See Lioclema occidens (Hall and Vhitfield).

Callopora ? crenulata Ulrich.

1893. Callopora crenulata. Ulrich, Geol. Minnesota, III, p. 284, pl. xxii, 18–23.
Trenton (Black River and Trenton): St. Paul and Cannon Falls, Minn sota; Decorah, Iowa; Neenah, Wisconsin.

Callopora dalei (Milne-Edwards and Haime).

1851. Chætetes Dalii. Milne-Edwards and Haime, Pol. Foss. Terr. Pal., p. 26 pl. xix, 6, 6*a*.
1854. Monticulipora Dalii. Milne-Edwards and Haime, British Foss. Coral p. 265.
1860. Monticulipora Dalii. Milne-Edwards, Hist. Nat. des Corall., III, p. 277.
1881. Monticulipora (Heterotrypa) ramosa var. dalei. Nicholson, Genus Mon ticulipora, p. 115, fig. 19, C, D, pl. ii, 4.
1882. Callopora dalei. Ulrich, Jour. Cincinnati Soc. Nat. Hist., V, p. 252.
1888. Monticulipora ramosa var. dalei. James and James, Jour. Cincinnati So Nat. Hist., X, p. 182.
1894. Monticulipora ramosa var. dalei. J. F. James, Jour. Cincinnati Soc. Na Hist., XVI, p. 205.
1874. Chætetes approximatus. Nicholson, Quar. Jour. Geol. Soc. London, XXX p. 502, pl. xxix, 3, 3*a*.
1875. Chætetes approximatus. Nicholson, Pal. Ohio, II, p. 193, pl. xxi, 3.
1883. Monticulipora approximatus. (Van Cleve) Hall, Twelfth Ann. Rep. Ind ana Geol. Nat. Hist., p. 250, pl. xi, 6.
Cincinnati (Lorraine): Cincinnati, Ohio, and vicinity.

Callopora ? ? diversa Hall.

1883. Callopora ? diversa. Hall, Trans. Albany Institute, X, p. 60 (abstrac 1879, p. 4).
1882. Callopora ? diversa. Hall, Eleventh Ann. Rep. Indiana Geol. Nat. Hist p. 239.
Niagara: Waldron, Indiana.
Obs. It is doubtful whether this species can be recognized in the absen of figures, from the description given.

Callopora dumalis Ulrich.

1893. Callopora dumalis. Ulrich, Geol. Minnesota, III, p. 282, pl. xxiii, 1–8.
Trenton (Stones River and Black River): St. Paul and Cannon Fall Minnesota.

Callopora elegantula Hall.

1852. Callopora elegantula. Hall, Pal. New York, II, p. 144, pl. xl, 1*a*–*m*.
1879. Callopora elegantula. Hall, Twenty-eighth Ann. Rep. New York Stat Mus., p. 115.
1882. Callopora elegantula. Hall, Eleventh Ann. Rep. Indiana Geol. Nat. Hist p. 237.
1882. Callopora elegantula. Ulrich, Jour. Cincinnati Soc. Nat. Hist., V, p. 25 pl. xi, 6–6*b*.
1896. Callopora elegantula. Ulrich, Zittel's Textb. Pal. (Engl. Ed.), fig. 45 A, B (p. 274).
1897. Callopora elegantula. Simpson, Fourteenth Ann. Rep. State Geologi New York for the year 1894, pl. xviii, 1–7.
Niagara: Lockport, New York; Waldron and Osgood, Indiana; Sterlin Illinois.

Callopora exsul Hall. See Lioclema? exsul (Hall).
Callopora fistulosa Hall. See Lioclema cellulosum (Hall).

pora florida Hall. See Lioclema? (Nicholsonella?) floridum (Hall).

pora geniculata Hall. See Callotrypa? geniculata (Hall).

pora goodhuensis Ulrich.

93. Callopora goodhuensis. Ulrich, Geol. Minnesota, III, p. 282, pl. xxiii, 9, 10, 21, 29.

Trenton: Cannon Falls and St. Paul, Minnesota.

pora Hamiltonensis Hall. See Streblotrypa hamiltonensis cholson).

pora hemispherica Hall. See Fistulipora? hemispherica (Hall).

pora heteropora Hall. See Callotrypa heteropora (Hall).

pora (Callotrypa) heteropora Hall. See Callotrypa heteropora ll).

pora Hyale Hall. See Cœlocaulis?? hyale (Hall).

pora (Cœlocaulis) Hyale Hall. See Cœlocaulis?? hyale (Hall).

pora incontroversa Ulrich.

86. Callopora incontroversa. Ulrich, Fourteenth Ann. Rep. Geol. Nat. Hist. Surv. Minnesota, p. 96.

93. Callopora incontroversa. Ulrich, Geol. Minnesota, III, p. 278, pl. xxii, 33–36.

Trenton (Stones River): Minneapolis, St. Paul, and Preston, Minnesota.

pora incrassata Nicholson. See Fistulipora incrassata (Nicholson).

pora internodata Hall. See Callotrypa internodata (Hall).

pora (Callotrypa) internodata Hall. See Callotrypa internodata ll.)

pora irregularis Hall. See Cœlocaulis? irregularis (Hall).

pora (Cœlocaulis) irregularis Hall. See Cœlocaulis? irregularis ll).

pora laminata Hall. See Lioclema? (Nicholsonella?) laminatum ll).

pora macropora Hall. See Callotrypa macropora (Hall) and Callo-a?? oppleta Hall and Simpson.

pora (Callotrypa) macropora Hall. See Callotrypa macropora ll).

pora macropora var. signata Hall. See Callotrypa macropora-nata (Hall).

pora (Callotrypa) macropora var. signata Hall. See Callotrypa cropora-signata (Hall).

pora maculosa Hall. See Fistulipora maculosa (Hall).

pora magnopora Foerste.

87. Callopora magnopora. Foerste, Bull. Sci. Lab. Denison Univ., II, p. 173; III, pl. xvi, 5.

95. Callopora magnopora. Foerste, Geol. Surv. Ohio, VII, p. 600, pl. xxix, 5.

Clinton: Dayton and Centerville, Ohio.

pora (Cœlocaulis) mediopora Hall. See Cœlocaulis? mediopora ll).

Callopora milfordensis James. See Ceramoporella granulosa-milfo
ensis (James).

Callopora minutissima Nicholson. See Lioclema minutissimum (Ni
olson).

Callopora missouriensis Rominger. See Lioclema punctatum (Hall)

Callopora multiseriata Hall. See Callotrypa multiseriata (Hall).

Callopora multitabulata (Ulrich).

1886. Monotrypella multitabulata. Ulrich, Fourteenth Ann. Rep. Geol.
Hist. Surv. Minnesota, p. 100.

1893. Callopora multitabulata. Ulrich, Geol. Minnesota, III, p. 280, pl. x
11, 12, 16, 17, 24–26, 30, 31.

1896. Callopora multitabulata. Ulrich, Zittel's Textb. Pal. (Engl. ed.), fig.
C, D (p. 274).

Trenton (Black River and Trenton): Burgin and Frankfort, Kentu
Minneapolis, St. Paul, and Cannon Falls, Minnesota; Nashville,
nessee; Ottawa, Canada.

Callopora nodulosa (Nicholson).

1874. Chætetes? nodulosus. Nicholson, Quar. Jour. Geol. Soc. London, X
p. 506, pl. xxix, 9, 9*a*.

1875. Chætetes nodulosus. Nicholson, Pal. Ohio, II, p. 200, pl. xxi, 10, 10*a*.

1876. Chætetes nodulosus. Nicholson, Ann. Mag. Nat. Hist., ser. 4, XV
p. 87, pl. v, 3.

1881. Monticulipora (Heterotrypa) nodulosa. Nicholson, Genus Monticulip
p. 116, pl. i, 4–4*d*.

1882. Callopora nodulosa. Ulrich, Jour. Cincinnati Soc. Nat. Hist., V, p.
ibid., VI, 1883, p. 83.

1888. Monticulipora nodulosa. James and James, Jour. Cincinnati Soc.
Hist., X, p. 182.

1894. Monticulipora nodulosa. J. F. James, Jour. Cincinnati Soc. Nat. H
XVI, p. 206.

Cincinnati (Utica): Cincinnati, Ohio, and vicinity.

Callopora ?? nummiformis Hall.

1852. Callopora nummiformis. Hall, Pal. New York, II, p. 148, pl. xl, 5*a*,

1890. Calloporella? nummiformis. Ulrich, Geol. Surv. Illinois, VIII, p. 416

Niagara: Lockport, New York.

Callopora oculifera Hall. See Callotrypa oculifera (Hall).

Callopora (Callotrypa) oculifera Hall. See Callotrypa oculifera (Ha

Callopora ohioensis Foerste. See Lioclemella ohioensis (Foerste).

Callopora onealli (James).

1875. Chætetes ? O'Nealli. James, Introd. Catal. Low. Sil. Foss., p. 2.

1888. Monticulipora o'nealli. James and James, Jour. Cincinnati Soc.
Hist., X, p. 174.

1889. Callopora onealli. Miller, North American Geol. Pal., p. 296.

1894. Monticulipora o'nealli. J. F. James, Jour. Cincinnati Soc. Nat. H
XVI, p. 194.

Not Monticulipora (Heterotrypa) O'Nealli. Nicholson, Genus Monti
pora, p. 118 = Callopora onealli-sigillarioides (Nicholson).

Cincinnati (Utica): Cincinnati, Ohio, and vicinity.

Callopora onealli-communis (James).

1882. Monticulipora (Heterotrypa) o'nealli ? var. communis. James, Paleo
ogist, No. 6, p. 47; ibid., No. 7, 1888, pl. i, 8.

Callopora onealli-communis (James)—Continued.

1888. Monticulipora communis. James and James, Jour. Cincinnati Soc. Nat. Hist., X, p. 175, pl. ii, 5 *a*, *b*.
1894. Monticulipora communis. J. F. James, Jour. Cincinnati Soc. Nat. Hist., XVI, p. 195.
Cincinnati (Utica): Cincinnati, Ohio, and vicinity.

Callopora onealli-sigillarioides (Nicholson).

1875. Chætetes sigillarioides. Nicholson, Pal. Ohio, II, p. 203, pl. xxii, 9, 9*a*.
1876. Chætetes sigillarioides. Nicholson, Ann. Mag. Nat. Hist., ser. 4, XVIII, p. 87, pl. v, 2.
1882. Callopora sigillaroidea. Ulrich, Jour. Cincinnati Soc. Nat. Hist., V, p. 252.
1889. Callopora sigillarioides. Miller, North American Geol. Pal., fig. 464 (p. 296).
1881. Monticulipora (Heterotrypa) O'Nealli (not of James). Nicholson, Genus Monticulipora, p. 118, pl. iii, 3–3*f*.
Cincinnati (Utica): Cincinnati, Ohio, and vicinity.

Callopora ?? oppleta Hall and Simpson.

1879. Callopora macropora (in part). Hall, Thirty-second Ann. Rep. New York State Mus., p. 152 (reprint, 1880, p. 14).
1883. Callopora macropora (in part). Hall, Rep. State Geologist New York for the year 1882, pl. xi, 23, 24.
1887. Callopora oppleta. Hall and Simpson, Pal. New York, VI, p. 21, pl. xi, 23, 24 (called Callopora macropora on plate).
Lower Helderberg; near Clarksville, N. Y.
Obs. This is probably a species of Eridotrypa.

Callopora parasitica Hall. See Lioclema parasiticum (Hall) and Cœlocaulis ? mediopora (Hall).

Callopora (Callotrypa) paucipora Hall. See Callotrypa paucipora (Hall).

Callopora perelegans Hall.

1874. Callopora perelegans. Hall, Twenty-sixth Ann. Rep. New York State Mus., p. 102.
1879. Callopora perelegans. Hall, Thirty-second Ann. Rep. New York State Mus., p. 154 (reprint, 1880, p. 16).
1883. Callopora perelegans. Hall, Rep. State Geologist New York for the year 1882, pl. xii, 10–17.
1887. Callopora perelegans. Hall and Simpson, Pal. New York, VI, p. 22, pl. xii, 10–17, pl. xxiii A, 14.
Lower Helderberg: Clarksville, New York.

Callopora ponderosa Hall. See Lioclema ponderosum (Hall).

Callopora pulchella Ulrich.

1893. Callopora pulchella. Ulrich, Geol. Minnesota, III, p. 283, pl. xxii, 1–12.
Trenton (Black River): St. Paul and Cannon Falls, Minnesota.

Callopora pulchella-persimilis Ulrich.

1893. Callopora pulchella var. persimilis. Ulrich, Geol. Minnesota, III, p. 284, pl. xxii, 13–17.
Trenton (Black River): Cannon Falls, Minnesota.

Callopora punctata Hall. See Lioclema punctatum (Hall).

Callopora punctillata Winchell. See Lioclema punctillatum (Winchell).

Callopora ramosa (D'Orbigny).

1850. Monticulipora ramosa. D'Orbigny, Prodr. de Pal., I, p. 25.
1851. Chætetes ramosus. Milne-Edwards and Haime, Pol. Foss. Terr. Pal 266, pl. xix, 2, 2*a*.
1854. Monticulipora ramosa. Milne-Edwards and Haime, British Foss. Co p. 265.
1860. Monticulipora ramosa. Milne-Edwards, Hist. Nat. des Corall., III, p.
1876. Chætetes ramosus. Nicholson, Ann. Mag. Nat. Hist., ser. 4, XVIII, p
1879. Monticulipora (Heterotrypa) ramosa. Nicholson, Pal. Tab. Corals, p. pl. xiii, 2, 2*a*.
1881. Chætetes ramosus. Quenstedt, Roehren- und Sternkorallen, p. 77, cxlvi, 13–18.
1881. Monticulipora (Heterotrypa) ramosa. Nicholson, Genus Monticulip p. 110, fig. 18, pl. ii, 2, 2*a*.
1882. Callopora ramosa. Ulrich, Jour. Cincinnati Soc. Nat. Hist., V, p. 25
1888. Monticulipora ramosa. James and James, Jour. Cincinnati Soc. Nat. H X, p. 181.
1890. Callopora ramosa. Ulrich, Geol. Surv. Illinois, VIII, fig. 5*b* (p. 315).
1894. Monticulipora ramosa. J. F. James, Jour. Cincinnati Soc. Nat. H XVI, p. 204.
1896. Monticulipora (Heterotrypa) ramosa. Zittel, Textb. Pal. (Engl. e fig. 185 (p. 103), fig. 186 B (p. 103).
1874. Chætetes Dalei (not of Milne-Edwards and Haime). Nicholson, Q Jour. Geol. Soc. London, XXX, p. 501, pl. xxix, 1, 1*a*.
1875. Chætetes Dalei (not of Milne-Edwards and Haime). Nicholson, Ohio, II, p. 192, pl. xxi, 1, 1*a*.
1883. Monticulipora Dalii. (Van Cleve) Hall, Twelfth Ann. Rep. Indiana G Nat. Hist., p. 249, pl. xi, 2.

Cincinnati (Lorraine): Cincinnati, Ohio, and vicinity.

Callopora ramosa var. rugosa Ulrich. See Callopora rugosa (Mil Edwards and Haime).

Callopora rugosa (Milne-Edwards and Haime).

1851. Chætetes rugosus. Milne-Edwards and Haime, Pol. Foss. Terr. Pal 268, pl. xx, 6, 6*a*.
1854. Monticulipora rugosa. Milne-Edwards and Haime, British Foss. Co p. 265.
1860. Monticulipora rugosa. Milne-Edwards, Hist. Nat. des Corall., III, p.
1874. Chætetes rugosus. Nicholson, Quar. Jour. Geol. Soc. London, XXX 502, pl. xxix, 2.
1875. Chætetes rugosus. Nicholson, Pal. Ohio, II, p. 193, pl. xxi, 2.
1876. Chætetes rugosus. Nicholson, Ann. Mag. Nat. Hist., ser. 4, XVIII, p pl. v, 4.
1877. Monticulipora rugosa. Dybowski, Die Chætetiden d. Ostb. Silur-Form 92, pl. iii, 1.
1881. Monticulipora (Heterotrypa) ramosa var. rugosa. Nicholson, Genus M ticulipora, p. 113, fig. 19, A, B, pl. ii, 3.
1881. Chætetes rugosus. Quenstedt, Roehren- und Sternkorallen, p. 78, cxlvi, 19, 20.
1882. Callopora ramosa var. rugosa. Ulrich, Jour. Cincinnati Soc. Nat. Hist. p. 252.
1888. Monticulipora ramosa var. rugosa. James and James, Jour. Cincinnati Nat. Hist., X, p. 182.

pora rugosa (Milne-Edwards and Haime)—Continued.

894. Monticulipora ramosa var. rugosa. J. F. James, Jour. Cincinnati Soc. Nat. Hist., XVI, p. 205.

Cincinnati (Lorraine): Cincinnati, Ohio, and vicinity.

ɔpora sigillaroidea Ulrich. See Callopora onealli-sigillarioides 'icholson).

ɔpora singularis Hall. See Trematopora ? singularis (Hall).

ɔpora (Callotrypa) striata Hall. See Callotrypa striata (Hall).

pora subnodosa Ulrich.

890. Callopora subnodosa. Ulrich, Geol. Surv. Illinois, VIII, p. 417, pl. xxxiii, 5, 5*c*, fig. 3*d* (p.308).

889. Callopora subnodosa. (Ulrich in press), Miller, North American Geol. Pal., fig. 465 (p. 296).

Cincinnati (Richmond): Blanchester, Waynesville, Hanover, and other localities in Ohio; Richmond and Versailles, Indiana; Wilmington and Savannah, Illinois; Iron Ridge, Wisconsin.

pora subplana Ulrich.

882. Callopora subplana. Ulrich, Jour. Cincinnati Soc. Nat. Hist., V, p. 253, pl. xi, 7, 7*b*.

894. Callopora subplana. J. F. James, Jour. Cincinnati Soc. Nat. Hist., XVI, p. 196.

Cincinnati (Lorraine): Cincinnati, Ohio, and vicinity.

pora undulata Ulrich.

886. Callopora undulata. Ulrich, Fourteenth Ann. Rep. Geol. Nat. Hist. Surv. Minnesota, p. 95.

893. Callopora undulata. Ulrich, Geol. Minnesota, III, p. 279, pl. xxii, 24–31.

Trenton (Black River): Minneapolis and St. Paul, Minnesota.

ɔpora unispina Hall. See Callotrypa unispina (Hall) and Callo-ypa striata (Hall).

ɔpora (Callotrypa) unispina Hall. See Callotrypa unispina (Hall).

ɔpora venusta Hall. See Cœlocaulis venusta (Hall).

ɔpora (Cœlocaulis) venusta Hall. See Cœlocaulis venusta (Hall).

LOPORELLA Ulrich. Genotype: Calloporella harrisi Ulrich = Mon-ɪulipora (Heterotrypa) circularis James.

882. Calloporella. Ulrich, Jour. Cincinnati Soc. Nat. Hist., V, p. 154.

889. Calloporella. Miller, North American Geol. Pal., p. 296.

890. Calloporella. Ulrich, Geol. Surv. Illinois, VIII, pp. 373, 418.

porella circularis (James).

882. Monticulipora (Heterotrypa) circularis. James, Paleontologist, No. 6, p. 46.

883. Monticulipora circularis. James, Paleontologist, No. 7, p. 58, pl. i, 3, 3*a*.

883. Calloporella harrisi. Ulrich, Jour. Cincinnati Soc. Nat. Hist., VI, p. 91, pl. i, 5–5*c*.

888. Monticulipora lens (not Nebulipora lens McCoy). James and James, Jour. Cincinnati Soc. Nat. Hist., X, p. 165.

894. Monticulipora lens (not Nebulipora lens McCoy). J. F. James, Jour. Cincinnati Soc. Nat. Hist., XVI, p. 181.

Cincinnati (Richmond): Oxford, Waynesville, Blanchester, and other localities in Ohio.

Calloporella harrisi Ulrich. See Calloporella circularis (James).

Calloporella ? lens (Whitfield).

1878. Fistulipora lens. Whitfield, Ann. Rep. Wisconsin Geol. Surv. for 18
p. 69.
1882. Fistulipora lens. Whitfield, Geol. Surv. Wisconsin, IV, p. 256, pl. xi, 5,
Cincinnati (Richmond): Delafield, Wisconsin.

Calloporella ? nodulosa Ulrich.

1890. Calloporella ? nodulosa. Ulrich, Geol. Surv. Illinois, VIII, p. 418,
xxxiii, 4, 4a.
1895. Monticulipora verrucosa. J. F. James, Jour. Cincinnati Soc. Nat. Hi
XVIII, p. 85.
Cincinnati (Richmond): Savannah, Illinois.

Calloporella ? nummiformis Ulrich. See Callopora ?? nummiforn
Hall.

CALLOTRYPA Hall and Simpson. Genotype: Callopora macropo
Hall.

1887. Callotrypa. Hall and Simpson, Pal. New York, VI, pp. xvi, 24.
1889. Callotrypa. Miller, North American Geol. Pal., p. 296.
1890. Callotrypa. Ulrich, Geol. Surv. Illinois, VIII, p. 376.
1897. Callotrypa. Simpson, Fourteenth Ann. Rep. State Geologist New Yo
for the year 1894, p. 551.

Callotrypa ? geniculata (Hall).

1886. Callopora geniculata. Hall, Fifth Ann. Rep. State Geologist New Yo
for the year 1885, pl. xxv, 1–3.
1887. Callopora geniculata. Hall and Simpson, Pal. New York, VI, p. 75,
xxv, 1–3.
Upper Helderberg: Ontario.

Callotrypa heteropora (Hall).

1874. Callopora heteropora. Hall, Twenty-sixth Ann. Rep. New York St
Mus., p. 102.
1879. Callopora heteropora. Hall, Thirty-second Ann. Rep. New York St
Mus., p. 153 (reprint, 1880, p. 15).
1883. Callopora heteropora. Hall, Rep. State Geologist New York for 18
pl. xi, 32–34, pl. xiii, 5–8.
1887. Callopora (Callotrypa) heteropora. Hall and Simpson, Pal. New Yo
VI, p. 25, pl. xi, 32–34, pl. xiii, 5–8, pl. xxiii, 3.
Lower Helderberg: Clarksville, New York.

Callotrypa internodata (Hall).

1883. Callopora internodata. Hall, Trans. Albany Institute, X, p. 182 (abstra
1881, p. 182).
1884. Callopora internodata. Hall, Rep. State Geologist New York for the ye
1883, p. 16.
1887. Callopora (Callotrypa) internodata. Hall and Simpson, Pal. New Yor
VI, p. 189.
Hamilton: Darien Center, New York.

Callotrypa macropora (Hall).

1874. Callopora macropora. Hall, Twenty-sixth Ann. Rep. New York Sta
Mus., p. 101.
1879. Callopora macropora. Hall, Thirty-second Ann. Rep. New York Sta
Mus., p. 152 (reprint, 1880, p. 14).

Callotrypa macropora (Hall)—Continued.

1883. Callopora macropora (in part). Hall, Rep. State Geologist New York for the year 1882, pl. xi, 23–29.

1887. Callopora (Callotrypa) macropora. Hall and Simpson, Pal. New York, VI, p. 24, pl. xi, 25–29, pl. xxiii, 15–19.

1897. Callotrypa macropora. Simpson, Fourteenth Ann. Rep. State Geologist New York for the year 1894, pl. xviii, 12–14.

Lower Helderberg: Catskill, Clarksville, and Schoharie, New York.

Callotrypa macropora-signata (Hall).

1874. Trematopora signata. Hall, Twenty-sixth Ann. Rep. New York State Mus., p. 104.

1879. Callopora macropora var. signata. Hall, Thirty-second Ann. Rep. New York State Mus., p. 153 (reprint, 1880, p. 15).

1883. Callopora macropora var. signata. Hall, Rep. State Geologist New York for the year 1882, pl. xi, 30, 31.

1887. Callopora (Callotrypa) macropora var. signata. Hall and Simpson, Pal. New York, VI, p. 25, pl. xi, 30, 31.

Lower Helderberg: Clarksville, New York.

Callotrypa multiseriata (Hall).

1883. Callopora multiseriata. Hall, Trans. Albany Institute, X, p. 149 (abstract, 1881, p. 7).

1883. Callopora multiseriata. Hall, Rep. State Geologist New York for the year 1882, pl. xxiv, 18, 19.

1886. Callopora multiseriata. Hall, Fifth Ann. Rep. State Geologist New York for the year 1885, pl. xxv, 6, 7.

1887. Callopora multiseriata. Hall and Simpson, Pal. New York, VI, p. 75, pl. xxv, 6, 7, pl. xxvi, 18, 19.

1889. Callotrypa multiseriata. Miller, North American Geol. Pal., p. 296.

1890. Callotrypa multiseriata. Ulrich, Geol. Surv. Illinois, VIII, p. 376.

Upper Helderberg: Le Roy, New York.

Callotrypa oculifera (Hall).

1879. Callopora oculifera. Hall, Thirty-second Ann. Rep. New York State Mus., p. 155 (reprint, 1880, p. 17).

1883. Callopora oculifera. Hall, Rep. State Geologist New York for the year 1882, pl. xiii, 10.

1887. Callopora (Callotrypa) oculifera. Hall and Simpson, Pal. New York, VI, p. 27, pl. xiii, 10, pl. xxiii, 6.

Lower Helderberg: Clarksville, New York.

Callotrypa paucipora (Hall and Simpson).

1887. Callopora (Callotrypa) paucipora. Hall and Simpson, Pal. New York, VI, pl. xxiii, 21. (Not described.)

Lower Helderberg: Clarksville, New York.

Callotrypa striata (Hall and Simpson).

1879. Callopora unispina (in part). Hall, Thirty-second Ann. Rep. New York State Mus., p. 153 (reprint, 1880, p. 15).

1883. Callopora unispina (in part). Hall, Rep. State Geologist New York for the year 1882, pl. xi, 35–41.

1887. Callopora (Callotrypa) striata. Hall and Simpson, Pal. New York, VI, p. 26, pl. xi, 38–41, pl. xxiii, 13, 14.

Lower Helderberg: Catskill Creek and Clarksville, New York.

Callotrypa unispina (Hall).

1874. Callopora unispina. Hall, Twenty-sixth Ann. Rep. New York State Mus., p. 102.

Callotrypa unispina (Hall)—Continued.

1879. Callopora unispina. Hall, Thirty-second Ann. Rep. New
p. 153 (reprint, 1880, p. 15).

1883. Callopora unispina. Hall, Rep. State Geologist New Y
1882, pl. xi, 35–39, ? 40–41.

1887. Callopora (Callotrypa) unispina. Hall and Simpson, P
p. 26, pl. xi, 35–37.

1897. Callotrypa unispina. Simpson, Fourteenth Ann. Rep.
Geologist for the year 1894, pl. xviii, 8–11.

Lower Helderberg: Catskill Creek and Clarksville, New

Carinopora Nicholson. See Semicoscinium Prout.

Carinopora Hindei Nicholson. See Semicoscinium hind

Cavea D'Orbigny. Not a Paleozoic genus.

Cavea prisca Gabb and Horn. See Streblotrypa pri
Horn).

CERAMELLA Hall and Simpson. Genotype: Ceramella
and Simpson.

1887. Ceramella. Hall and Simpson, Pal. New York, VI, p. xi

1889. Ceramella. Miller, North American Geol. Pal., p. 296.

1897. Ceramella. Simpson, Fourteenth Ann. Rep. State Geolo
the year 1894, p. 527.

Obs.—This genus is probably a synonym of either Gly
Phractopora Hall. The figures and description are insu
the specimens being apparently young.

Ceramella scidacea Hall and Simpson.

1887. Ceramella scidacea. Hall and Simpson, Pal. New Y
pl. lxiv, 5–8.

1897. Ceramella scidacea. Simpson, Fourteenth Ann. Rep. Sta
York for the year 1894, pl. xiv, 2–6.

Hamilton: Spurgen's Glen, Norton's Landing, Cayuga
Center, New York.

CERAMOPHYLLA Ulrich. Genotype: Ceramophylla fr

1893. Ceramophylla. Ulrich, Geol. Minnesota, III, p. 331.

Ceramophylla frondosa Ulrich.

1893. Ceramophylla frondosa. Ulrich, Geol. Minnesota, III,
3–7.

1896. Ceramophylla frondosa. Ulrich, Zittel's Textb. Pal. (
(p. 268).

Trenton (Black River): St. Paul and Goodhue County,

CERAMOPORA Hall. Genotype: Ceramopora imbricata

1852. Ceramopora. Hall, Pal. New York, II, p. 168.

1860. Ceramopora. Eichwald, Lethæa Rossica, I, p. 412.

1882. Ceramopora. Ulrich, Jour. Cincinnati Soc. Nat. Hist., V,

1887. Ceramopora. Foerste, Bull. Sci. Lab. Denison Univ., II,

1887. Ceramopora. Hall and Simpson, Pal. New York, VI, p.

1888. Ceramopora. James and James, Jour. Cincinnati Soc.
p. 36.

1889. Ceramopora. Miller, North American Geol. Pal., p. 29

1890. Ceramopora. Ulrich, Geol. Sur. Illinois, VIII, pp. 380,

1896. Ceramopora. Ulrich, Zittel's Textb. Pal. (Engl. ed.), p

MOPORA Hall—Continued.

397. Ceramopora. Simpson, Fourteenth Ann. Rep. State Geologist New York for the year 1894, p. 563.

mopora agellus Hall. See Ceramopora ? confluens Hall.

mopora alternata James. See Cœloclema alternatum (James).

nopora ? beani James. See Paleschara beani (James).

mopora clypeiformis Hall. Not recognized.

383. Ceramopora (Lichenalia?) clypeiformis. Hall, Trans. Albany Institute, X, p. 188 (abstract, 1881, p. 188).

384. Lichenalia (Ceramopora) clypeiformis. Hall, Rep. State Geologist New York for the year 1883, p. 37.

Hamilton: York, Moscow, New York.

mopora concentrica James. See Cœloclema concentricum (James).

nopora ? confluens Hall.

376. Ceramopora confluens. Hall, Twenty-eighth Ann. Rep. New York State Museum (documentary edition), pl. vii, 4, 5; ibid. (Museum edition, 1879), p. 119, pl. viii, 4, 5.

382. Ceramopora confluens. Hall, Eleventh Ann. Rep. Indiana Geol. Nat. Hist., p. 243, pl. vii, 4, 5.

397. Ceramopora confluens. Simpson, Fourteenth Ann. Rep. State Geologist New York for the year 1894, pl. xx, 14, 15.

376. Ceramopora ? (Berenicea) labecula. Hall, Twenty-eighth Ann. Rep. New York State Mus. (documentary edition), pl. viii, 1–3; ibid. (Museum edition), 1879, p. 119, pl. viii, 1–3.

382. Ceramopora labecula. Hall, Eleventh Ann. Rep. Indiana Geol. Nat. Hist., p. 242, pl. vii, 1–3.

397. Ceramopora labecula. Simpson, Fourteenth Ann. Rep. State Geologist New York for the year 1894, pl. xx, 11.

376. Ceramopora agellus. Hall, Twenty-eighth Ann. Rep. New York State Mus. (documentary edition), pl. viii, 6; ibid. (Museum edition), 1879, p. 120, pl. viii, 6.

382. Ceramopora agellus. Hall, Eleventh Ann. Rep. Indiana Geol. Nat. Hist., p. 243, pl. vii, 6.

Niagara: Waldron, Indiana.

Obs. This species is probably a fistuliporoid. C. agellus and C. labecula are apparently young specimens.

nopora ? expansa (James).

379. Alveolites expansa. James, Paleontologist, No. 3, p. 19.

387. Ceramopora expansa. Foerste, Bull. Sci. Lab. Denison Univ., II, p. 169; ibid., III, 1888, pl. xvii, 13.

Clinton: Clinton County, Ohio.

nopora ? explanata Hall.

383. Ceramopora? (Lichenalia?) explanata. Hall, Trans. Albany Institute, X, p. 61 (abstract, 1879, p. 5).

382. Ceramopora ? (Lichenalia?) explanata. Hall, Eleventh Ann. Rep. Indiana Geol. Nat. Hist., p. 245.

Niagara: Waldron, Indiana.

mopora foliacea Hall. See Meekopora foliacea (Hall).

mopora ? (Lichenalia) foliacea Hall and Simpson. See Fistuora foliacea (Hall).

Ceramopora Huronensis Nicholson. See Fistulipora h
(Nicholson).

Ceramopora imbricata Hall.

1852. Ceramopora imbricata. Hall, Pal. New York, II, p. 169, pl. xlE,
1890. Ceramopora imbricata. Ulrich, Geol. Surv. Illinois, VIII,
xxxix, 1–*b*.
Niagara: Lockport, New York; Osgood, Indiana.

Ceramopora ?? imbricella (Hall).

1883. Lichenalia (Ceramopora) imbricella. Hall, Trans. Albany I
p. 188 (abstract 1881, p. 188).
1884. Lichenalia (Ceramopora) imbricella. Hall, Rep. State Geologist
for the year 1883, p. 37.
1887. Ceramopora imbricella. Hall and Simpson, Pal. New York, VI,
Hamilton: Near Alden, Erie County, New York.
Obs. It is doubtful whether this form can be recognized
descriptions given.

Ceramopora ?? incrustans Hall.

1852. Ceramopora incrustans. Hall, Pal. New York, II, p. 169, pl. xlE
Niagara: Lockport, New York.
Obs. A reexamination of the type specimens of this specie
probably show it to be a species of Fistulipora. In that
require renaming, as the name is preoccupied by the genot
tulipora.

Ceramopora ? irregularis James. See Batostoma implicatu
olson).

Ceramopora labecula Hall. See Ceramopora ? confluens Ha

Ceramopora ? (Berenicea) labecula Hall. See Ceramopora ?
Hall.

Ceramopora ? labeculoidea Hall.

1879. Ceramopora labeculoidea. Hall, Thirty-second Ann. Rep. New
Mus., p. 158 (reprint 1880, p. 20).
1883. Ceramopora labeculoidea. Hall, Rep. State Geologist New Y
year 1882, pl. xvi, 1, 2.
1887. Ceramopora labeculoidea. Hall and Simpson, Pal. New Yor
pl. xvi, 1, 2.
1897. Ceramopora labeculoidea. Simpson, Fourteenth Ann. Rep. Sta
New York for the year 1894, pl. xx, 10.
Lower Helderberg: Clarksville, New York.
Obs. This species is probably the young of some fistuliporoid.

Ceramopora ? maculata Hall.

1874. Ceramopora maculata. Hall, Twenty-sixth Ann. Rep. New
Mus., p. 108.
1879. Ceramopora maculata. Hall, Thirty-second Ann. Rep. New
Mus., p. 159 (reprint, 1880, p. 21).
1883. Ceramopora maculata. Hall, Rep. State Geologist New York
1882, pl. xvi, 5–11.
1887. Ceramopora maculata. Hall and Simpson, Pal. New York, V
xvi, 5–11.
1897. Ceramopora maculata. Simpson, Fourteenth Ann. Rep. Stat
New York for the year 1894, pl. xx, 5–9.
Lower Helderberg: Clarksville and Schoharie, New York.

ramopora (Berenicea) maxima Hall. Abandoned by the author.
1874. Ceramopora (Berenicea) maxima. Hall, Twenty-sixth Ann. Rep. New York State Mus., p. 109.
1879. Ceramopora (Berenicea) maxima. Hall, Thirty-second Ann. Rep. New York State Mus., p. 159 (reprint, 1880, p. 21.)
1883. Ceramopora (Berenicea) maxima. Hall, Rep. State Geologist New York for the year 1882, pl. xvi, 12.
Lower Helderberg: Schoharie, New York.
Obs. In the Pal. New York, VI, 1887, p. 34, Hall and Simpson say that this name may be dropped from the list of determined species.

ramopora nicholsoni (James). See Chiloporella nicholsoni (James).

ramopora ? notha Hall.
1883. Ceramopora (Paleschara ?) nothus. Hall, Trans. Albany Institute, X, p. 62 (abstract, 1879, p. 6.)
1882. Ceramopora (Paleschara ?) nothus. Hall, Eleventh Ann. Rep. Indiana Geol. Nat. Hist., p. 244.
Niagara: Waldron, Indiana.

ramopora (Paleschara ?) nothus Hall. See Ceramopora ? notha Hall.

ramopora Ohioensis (Nicholson). See Ceramoporella ohioensis (Nicholson).

ramopora ? orbiculata Ringueberg.
1886. Ceramopora orbicutata. Ringueberg, Bull. Buffalo Soc. Nat. Hist., V, p. 19, pl. ii, 13, 13*a*.
Niagara: Lockport, New York.

ramopora ? parvicella Hall.
1879. Ceramopora parvicella. Hall, Thirty-second Ann. Rep. New York State Mus., p. 158 (reprint, 1880, p. 20.)
1883. Ceramopora parvicella. Hall, Rep. State Geologist New York for the year 1882, pl. xvi, 3, 4.
1887. Ceramopora ? parvicella. Hall and Simpson, Pal. New York, VI, p. 34, pl. xvi, 3, 4.
1897. Ceramopora parvicella. Simpson, Fourteenth Ann. Rep. State Geologist New York for the year 1894, pl. xx, 12, 13.
Lower Helderberg: Clarksville, New York.

ramopora radiata James. Not recognizable.
1878. Ceramopora radiata. James, Paleontologist, No. 2, p. 12.
Cincinnati: Cincinnati, Ohio
Obs. An examination of the type specimen can alone decide just what form this is, but it is probably a young example of Ceramoporella granulosa-milfordensis (James).

ramopora ? raripora Hall.
1883. Ceramopora raripora. Hall, Trans. Albany Institute, X, p. 62 (abstract 1879, p. 6.)
1882. Ceramopora raripora. Hall, Eleventh Ann. Rep. Indiana Geol. Nat. Hist., p. 244.
Niagara: Waldron, Indiana.

ramopora whitei (James). See Ceramoporella whitei (James).

RAMOPORELLA Ulrich. Genotype: Ceramoporella distincta Ulrich.
1882. Ceramoporella. Ulrich, Jour. Cincinnati Soc. Nat. Hist., V, p. 156.
1889. Ceramoporella. Miller, North American Geol. Pal., p. 297.

CERAMOPORELLA Ulrich—Continued.

1890. Ceramoporella. Ulrich, Geol. Surv. Illinois, VIII, pp. 380, 464.

1893. Ceramoporella. Ulrich, Geol. Minnesota, III, p. 328.

1896. Ceramoporella. Ulrich, Zittel's Textb. Pal. (Engl. ed.), p. 267.

1897. Ceramoporella. Simpson, Fourteenth Ann. Rep. State Geologist N for the year 1894, p. 564.

Ceramoporella distincta Ulrich.

1890. Ceramoporella distincta. Ulrich, Geol. Surv. Illinois, VIII, p. xxxix, 6, 6*a*.

Not Ceramoporella distincta. Ulrich, Geol. Minnesota, III, 189 pl. xxviii, 13; Zittel's Textb. Pal. (Engl. ed.), 1896, fig. 435 (Simpson, Fourteenth Ann. Rep. State Geol. New York for the y 1897, fig. 130 (p. 565).

Cincinnati (Utica and Lorraine): Cincinnati, Ohio, and vicinity.

Ceramoporella granulosa Ulrich.

1890. Ceramoporella granulosa. Ulrich, Geol. Surv. Illinois, VIII, p. 46 2, 2*a*.

Cincinnati (Richmond): Wilmington, Illinois; Iron Ridge, Wi Richmond and Versailles, Indiana; Oxford, Waynesville, an localities in Ohio.

Obs. Hall and Simpson (Pal. New York, VI, 1887, pl. xiv, 15–17, 4) figure the Cincinnati (Utica) form of this as Fistulipora sp.? 17 is incorrect, no vesicles or vesicular tissue being found in this

Ceramoporella granulosa-milfordensis James.

1878. Callopora milfordensis. James, Paleontologist, No. 2, p. 11.

1888. Monticulipora (Fistulipora) milfordensis. James and James, Jour nati Soc. Nat. Hist., XI, p. 36. pl. i, 7–7*b*.

1896. Monticulipora (Fistulipora) milfordensis. J. F. James, Jour. Ci Soc. Nat. Hist., XVIII, p. 122.

Cincinnati (Utica): Milford, Ohio; Cincinnati, Ohio, and vicinity.

Ceramoporella inclusa Ulrich.

1893. Ceramoporella inclusa. Ulrich, Geol. Minnesota, III, p. 329, pl. 8–11.

1897. Ceramoporella inclusa. Simpson, Fourteenth Ann. Rep. State G New York for the year 1894, fig. 132 (p. 565).

Trenton (Stones River, Black River, and Trenton): Minneapolis, Cannon Falls, and several localities in Goodhue and Fillmore c Minnesota.

Ceramoporella interporosa Ulrich.

1893. Ceramoporella interporosa. Ulrich, Geol. Minnesota, III, p. 330, pl 12.

1897. Ceramoporella interporosa. Simpson, Fourteenth Ann. Rep. Stat gist New York for the year 1894, fig. 131 (p. 565).

Trenton: Goodhue County, Minnesota.

Ceramoporella? irregularis (Whitfield).

1878. Alveolites irregularis. Whitfield, Ann. Rep. Wisconsin Geol. S 1877, p. 72.

1882. Alveolites irregularis. Whitfield, Geol. Surv. Wisconsin, IV, p. xi, 1, 2.

Cincinnati (Richmond): Iron Ridge, Wisconsin.

moporella ohioensis (Nicholson).

875. Ceramopora Ohioensis. Nicholson, Pal. Ohio, II, p. 265, pl. xxv, 10*a*, *b*, *e* (not 10*c*, *d*).

888. Ceramopora ohioensis. James and James, Jour. Cincinnati Soc. Nat. Hist., XI, p. 37.

889. Ceramopora ohioensis. Miller, North American Geol. Pal., fig. 466 (p. 297).

890. Ceramoporella? ohioensis. Ulrich, Geol. Surv. Illinois, VIII, p. 466, pl. xxxix, 2, 2*a*.

Cincinnati (Utica, Lorraine, and Richmond): Cincinnati, Ohio, and vicinity. A common species in the Utica, Lorraine, and Richmond groups of Ohio, Indiana, Kentucky, Tennessee, Illinois, and Wisconsin.

moporella stellata Ulrich.

890. Ceramoporella stellata. Ulrich, Geol. Surv. Illinois, VIII, p. 465, pl. xli, 1, 1*a*.

Cincinnati (Richmond): Sterling, Illinois.

noporella whitei (James).

878. Ceramopora Whitei. James, Paleontologist, No. 2, p. 12.

888. Ceramopora? whitei. James and James, Jour. Cincinnati Soc. Nat. Hist., XI, p. 38, pl. i, 9, 9*a*.

Cincinnati (Lorraine and Richmond): Cincinnati, Ohio, and vicinity. Richmond and Versailles, Indiana; Oxford, Waynesville, and other localities in Ohio.

pora Goldfuss. Not a Paleozoic genus.

pora constellata Van Cleve (Mss.). See Constellaria constellata an Cleve) Dana.

pora? Hamiltonensis Nicholson. See Streblotrypa hamiltonensis icholson).

pora ramosa D'Orbigny. Not recognizable without material.

42. Ceriopora ramosa. D'Orbigny, Voyage dans l'Amérique Méridonale, III, p. 56, pl. vi, 9, 10.

Carboniferous: Yarbichambi, Bolivia.

TETES Fischer. Genotype Chætetes radians Fischer. Not considered a bryozoan.

37. Chætetes. Fischer, Oryct. du Gouv. Moscou, p. 159.

Not Chætetes of many authors who have used the name for true bryozoa.

etes abruptus Hall. See Monotrypella? abrupta (Hall).

etes (Monotrypella) abruptus Hall and Simpson. See Monotryla? abrupta (Hall).

etes æquidistans Hall. Can not be recognized.

83. Chætetes æquidistans. Hall, Trans. Albany Institute, X, p. 146 (abstract, 1881, p. 4).

Upper Helderberg, New York.

etes approximatus Nicholson. See Callopora dalei (Milnewards and Haime).

etes (Monotrypella) arbusculus Hall. See Monotrypella ? arbusa (Hall).

etes attritus Nicholson. See Dekayia aspera (Milne-Edwards and ime).

Chætetes Barrandi Nicholson. See **Heterotrypa ? barrandei** (Nicholson).

Chætetes briareus Nicholson. See **Eridotrypa briareus** (Nicholson).

Chætetes calyculus James. See **Aspidopora calycula** (James).

Chætetes ? carbonarius Worthen. See **Stenopora carbonaria** (Worthen).

Chætetes cincinnatiensis James. See **Monticulipora cincinnatiensis** (James).

Chætetes ? clathratulus (James) Nicholson. See **Escharopora pavonia** (D'Orbigny).

Chætetes clavacoideus James. See **Leptotrypa clavacoidea** (James).

Chætetes colliculatus Hall. See **Monotrypa colliculata** (Hall).

Chætetes columnaris Hall. **Belongs to genus Tetradium, now considered a coral.**

1847. Chætetes columnaris. Hall, Pal. New York, I, p. 68, pl. xxiii, 4, *4a*.

Chætetes compressus Ulrich. See **Peronopora compressa** (Ulrich).

Chætetes consimilis Hall. See **Monotrypella ? consimilis** (Hall).

Chætetes constellatus Quenstedt. See **Constellaria constellata** (Van Cleve) Dana.

Chætetes corticans Nicholson. See **Spatiopora corticans** (Nicholson).

Chætetes corticosa Hall. See **Eridotrypa corticosa** (Hall).

Chætetes crebriramus Hall. Not recognized.

1883. Chætetes crebriramus. Hall, Trans. Albany Institute, X, p. 146 (abstract, 1881, p. 4).

Hamilton: Falls of the Ohio.

Chætetes crustulatus James. Not recognizable.

1878. Chætetes crustulatus. James, Paleontologist, No. 1, p. 1; ibid., No. 3, 1879, p. 20.

1888. Monticulipora crustulata. James and James, Jour. Cincinnati Soc. Nat. Hist., XI, p. 23, pl. i, 2, *2a*.

1895. Monticulipora crustulata. J. F. James, Jour. Cincinnati Soc. Nat. Hist., XVIII, p. 82.

Cincinnati: Cincinnati, Ohio.

Obs. A variety of forms was included under this name, many of which have since been given other names. The description is so general that it can not be narrowed down to one recognizable form; hence, in the interests of science, the name should be dropped.

Chætetes dalei Milne-Edwards and Haime. See **Callopora dalei** (Milne-Edwards and Haime).

Chætetes dalei Nicholson (not Milne-Edwards and Haime). See **Callopora ramosa** (D'Orbigny).

Chætetes decipiens Rominger. See **Peronopora decipiens** (Rominger).

Chætetes delicatulus Nicholson. See **Bythopora delicatula** (Nicholson).

Chætetes (Monotrypella) densus Hall and Simpson. See **Monotrypella ? densa** (Hall).

Chætetes discoideus James. See **Amplexopora ? discoidea** (James).

etes egenus Hall. Not recognized.

33. Chætetes egenus. Hall, Trans. Albany Institute, X, p. 146 (abstract, 1881, p. 4).

Upper Helderberg: Onondaga Valley, New York.

etes elegans Ulrich. See Discotrypa elegans (Ulrich).

tes ?? expansus Ringueberg.

36. Chætetes expansus. Ringueberg, Bull. Buffalo Soc. Nat. Hist., V, p. 20, pl. ii, 17.

Niagara: Lockport, New York.

Obs. Probably a valid species, but requires further study to determine generic position.

etes filiasus Milne-Edwards and Haime. See Amplexopora filiosa Orbigny).

etes Fletcheri Nicholson (not Milne-Edwards and Haime). See xayella ulrichi (Nicholson).

etes Fletscheri Quenstedt (not Milne-Edwards and Haime). See xayella ulrichi (Nicholson).

etes frondosus Milne-Edwards and Haime. See Heterotrypa ndosa (D'Orbigny).

etes frondosus Nicholson (not D'Orbigny). See Peronopora ipiens (Rominger).

etas frondosus Quenstedt. See Peronopora decipiens (Rominger) Heterotrypa frondosa (D'Orbigny).

etes frondosus limatus Quenstedt. See Heterotrypa frondosa Orbigny).

etes fruticosus Hall. (Lower Helderberg.) Name preoccupied. Monotrypella? arbuscula (Hall).

etes fruticosus Hall (Hamilton). Can not be recognized.

76. Chætetes fruticosus. Hall, Illus. Devonian Foss., pl. xxxviii, 1–5. (Not described.)

99. Monotrypa fruticosa. (Hall's species ?) Grabau, Bull. Buffalo Soc. Nat. Sci., VI, p. 136, fig. 20.

Hamilton: Canandaigua Lake and Eighteenmile Creek, New York.

etes furcatus Hall. Can not be recognized.

76. Chætetes furcatus. Hall, Illus. Devonian Foss., pl. xxxvii, 1–5, pl. xxxviii, 6–9. (Not described.)

99. Monotrypa? furcata. (Hall's species ?) Grabau, Bull. Buffalo Soc. Nat. Sci., VI, p. 137, fig. 21.

Hamilton: Norton's Landing and Eighteenmile Creek, New York.

etes fusiformis Whitfield. See Lioclemella fusiformis (Whitd).

etes gracilis James. See Bythopora gracilis (Nicholson).

etes granuliferus Ulrich. See Homotrypella granulifera (Ulrich).

tes ?? hamiltonensis Winchell.

36. Chætetes Hamiltonensis. Winchell, Rep. Low. Penin. Michigan, p. 89.

Hamilton, Petoskey, Michigan.

Obs. A valid species, but requires further investigation to determine its generic position.

Chætetes Helderbergiæ Hall. See Monotrypa ? helderber

Chætetes humilis Hall. Can not be recognized.

1876. Chætetes humilis. Hall, Illus. Devonian Foss., pl. xxxvii, described.)

1881. Chætetes humilis. Quenstedt, Roehren- und Sternkoraller cxlv, 34.

Upper Helderberg: Western New York.

Chætetes implicata Ulrich. See Batostoma implicatum (Ni

Chætetes internascens Hall. Not recognized.

1883. Chætetes ? (Trematopora?) internascens. Hall, Trans. Alb X, p. 147 (abstract, 1881, p. 5).

Hamilton: Falls of the Ohio.

Chætetes irregularis Ulrich. See Leptotrypa ? irregular

Chætetes Jamesi Nicholson. See Batostoma jamesi (Nicho

Chætetes læviramus Quenstedt. See Bythopora gracilis (

Chætetes lycoperdon (Say) Hall. Not recognizable.

—— Chætetes lycoperdon. Say (Mss.).

1847. Chætetes lycoperdon. Hall, Pal. New York, I, p. 64, pl. x xxiv, 1*a*–*o*, 2, 2*a*, 3; ibid., p. 48, pl. xii, 3, 5; ibid., p. 276, pl.

1852. Chætetes lycoperdon. Hall, Pal. New York, II, p. 40, pl. xvi

1874. Chætetes lycoperdon. Nicholson and Hinde, Canadian Jo XIV, p. 140.

1881. Chætetes lycoperdon. Quenstedt, Roehren- und Sternkora cxlvi, 1, 2.

Trenton.

Obs. The term lycoperdon has deservedly fallen into disu never properly defined and limited, the name came to be authors for any and every kind of bryozoan, especiall hemispheric or globose shape.

Chætetes lycoperdon James (not Hall).

1878. Chætetes lycoperdon. James, Paleontologist, No. 2, p. 11.

1879. Chætetes lycopodites (not Vanuxem). James, Paleontologis

Cincinnati: Cincinnati, Ohio.

Obs. The form thus referred by James can not be identifie

Chætetes lycopodites James (not Vanuxem). See Chætetes James (not Hall).

Chætetes mammulatus Milne-Edwards and Haime. See Mo mammulata (D'Orbigny).

Chætetes mammulatus Nicholson (not D'Orbigny). See H frondosa (D'Orbigny).

Chætetes mammulatus Quenstedt (not D'Orbigny).

1881. Chætetes mammulatus. Quenstedt, Roehren- und Sternkor cxlvi, 10, 11 (not 12).

Cincinnati (Richmond): Richmond, Indiana.

Obs. This is a species that has not yet been described.

Chætetes meeki James. See Bythopora meeki (James).

Chætetes ?? microscopicus Winchell.

1866. Chætetes microscopicus. Winchell, Rep. Low. Penin. Michig

Hamilton: Petoskey, Michigan.

es ?? microscopicus Winchell—Continued.

6. Obs. A valid species, but further investigation is needed to determine generic position.

tes minutus James. See Bythopora delicatula (Nicholson).

tes moniliformis Nicholson. See Heterotrypa ? moniliformis
holson).

tes monticulatus Hall. See Monotrypa monticulata (Hall).

tes muscatinensis White. Not a bryozoan.

6. Chætetes Muscatinensis. White, Proc. Acad. Nat. Sci. Philadelphia, p. 27.
Hamilton: Muscatine, Iowa.

tes Newberryi Nicholson. See Aspidopora newberryi (Nichol-
.

tes nodulosus Nicholson. See Callopora nodulosa (Nicholson).

tes ? O'Nealli James. See Callopora onealli (James).

tes Ortoni Nicholson. See Atactoporella ortoni (Nicholson).

tes papillatus Nicholson (not McCoy).

4. Chætetes papillatus Nicholson (not McCoy). Nicholson, Quar. Jour. Geol. Soc. London, XXX, p. 513, pl. xxix, 12–12*b*.

5. Chætetes papillatus (not McCoy). Nicholson, Pal. Ohio, II, p. 210.
Cincinnati: Cincinnati, Ohio.
Obs. The form so referred can not be identified with certainty from Nicholson's description and figures, but it was probably a species of Petigopora, possibly the P. asperula Ulrich.

tes pavonia Milne-Edwards and Haime. See Escharopora
nia (D'Orbigny).

tes petechialis Nicholson. See Petigopora petechialis (Nichol-
.

tes petropolitanus James (not Pander).

3. Chætetes petropolitanus. James, Paleontologist, No. 2, p. 11.
Cincinnati: Cincinnati, Ohio.
Obs. The form so referred by James is probably Amplexopora petasiformis (Nicholson).

tes petropolitanus Meek and Worthen (not Pander).

3. Chætetes petropolitanus Pander (?). Meek and Worthen, Geol. Surv. Illinois, III, p. 304, pl. ii, 8*a*, *b*.
Trenton: Scales Mound, Illinois.
Obs. Further investigation is needed to determine what the form is which Meek and Worthen referred as above.

tes petropolitanus Nicholson (in part). See Mesotrypa whiteavesi
holson).

tes petropolitanus of various authors (not Pander).

Obs. A great variety of forms agreeing in having a discoid or hemispheric shape and differing, often greatly, in internal structure, has been confused under this name. Without an examination of the various specimens, no synonymy can be given.

es ?? ponderosus Rominger.

2. Chætetes ponderosus. Rominger, American Geologist, X, p. 58, pl. iii, 4–8.
Hamilton: Falls of the Ohio.

Chætetes pulchellus Nicholson (not Milne-Edwards and Haime). See Callopora andrewsi (Nicholson).

Chætetes quadrangularis Nicholson. See Leptotrypa ? quadrangularis (Nicholson).

Chætetes quadratus Rominger. See Monotrypella quadrata (Rominger).

Chætetes ramosus Milne-Edwards and Haime. See Callopora ramosa (D'Orbigny).

Chætetes rhombicus Nicholson. See Monotrypella quadrata (Rominger).

Chætetes ?? rugosus Hall.

1847. Chætetes rugosus. Hall., Pal. New York, I, p. 67, pl. xxiv, 2*a*, *b*.
Trenton: Middleville, Herkimer County, New York.
Obs. The generic position can not be determined from the description and figures given.

Chætetes rugosus Milne-Edwards and Haime. See Callopora rugosa (Milne-Edwards and Haime).

Chætetes sigillarioides Nicholson. See Callopora onealli-sigillarioides (Nicholson).

Chætetes spherica Hall. See Monotrypa spherica (Hall).

Chætetes subglobosa Ulrich. See Monotrypa turbinata (James).

Chætetes subpulchellus Nicholson. See Heterotrypa subpulchella (Nicholson).

Chætetes subrotundus James. Not a bryozoan.

1878. Chætetes subrotundus. James, Paleontologist, No. 2, p. 11.

Chætetes tabulatus Hall. See Monotrypa tabulata (Hall).

Chætetes (Ptychonema) tabulatus Hall and Simpson. See Monotrypa tabulata (Hall).

Chætetes ?? tenuis Hall.

1876. Chætetes tenuis. Hall, Illus. Devonian Foss., pl. xxxvii, 6-10. (Not described.)
1892. Monotrypa tennis (in error for tenuis). Rominger, American Geologist, X, p. 60, pl. iii, 1–3.
Upper Helderberg: Genesee County, New York (Hall).
Hamilton: Falls of the Ohio (Rominger).

Chætetes tuberculatus Milne-Edwards and Haime. See Spatiopora tuberculata (Milne-Edwards and Haime).

Chætetes tuberculatus Nicholson (not Milne-Edwards and Haime). See Spatiopora corticans (Nicholson).

Chætetes turbinatum James. See Monotrypa turbinata (James).

Chætetes undulatus Nicholson. See Monotrypa undulata (Nicholson).

Chætetes varians James. See Batostoma varians (James).

Chætetes venustus Ulrich. See Crepipora venusta (Ulrich).

CHAINODICTYON Foerste. Genotype: Chainodictyon laxum Foerste.

1887. Chainodictyon. Foerste, Bull. Sci. Lab. Denison Univ., II, p. 81.
1889. Chainodictyon. Miller, North American Geol. Pal., p. 297.
1890. Chainodictyon. Ulrich, Geol. Surv. Illinois, VIII, pp. 399, 640.

odictyon laxum Foerste.

37. Chainodictyon laxum. Foerste, Bull. Sci. Lab. Denison Univ., II, p. 81, pl. vii, 8*a–c*.

Lower Coal Measures: Flint Ridge, Ohio; Seville, Illinois.

odictyon laxum-minor Ulrich.

90. Chainodictyon laxum var. minor. Ulrich, Geol. Surv. Illinois, VIII, p. 640, pl. lxii, 3, 3*a*.

Lower Coal Measures: Seville, Illinois.

oporella. See Chiloporella.

otrypa. See Chilotrypa.

OPORELLA Ulrich. Genotype: Fistulipora flabellata Ulrich = amopora Nicholsoni James.

32. Cheiloporella. Ulrich, Jour. Cincinnati Soc. Nat. Hist., V, p. 157.

39. Chiloporella. Miller, North American Geol. Pal., p. 297.

90. Chiloporella. Ulrich, Geol. Surv. Illinois, VIII, p. 381.

97. Chiloporella. Simpson, Fourteenth Ann. Rep. State Geologist New York for the year 1894, p. 565.

porella flabellata Ulrich. See Chiloporella nicholsoni (James).

orella nicholsoni (James).

75. Ceramopora Nicholsoni. James, Catal. Foss. Cincinnati Group, p. 3.

38. Monticulipora (Fistulipora) nicholsoni. James and James, Jour. Cincinati Soc. Nat. Hist., XI, p. 34, pl. i, 6–6*c*.

96. Monticulipora (Fistulipora) nicholsoni. J. F. James, Jour. Cincinnati Soc. Nat. Hist., XVIII, p. 121, fig. 12.

78. Fistulipora? multipora. James, Paleontologist, No. 1, p. 2.

79. Fistulipora Siluriana. James, Paleontologist, No. 3, p. 19.

79. Fistulipora flabellata. Ulrich, Jour. Cincinnati Soc. Nat. Hist., II, p. 28, pl. vii, 26–26*b*.

90. Chiloporella flabellata. Ulrich, Geol. Surv. Illinois, VIII, p. 381, pl. xxxix, 5–5*b*.

Cincinnati (Lorraine): Cincinnati, Ohio, and vicinity.

OTRYPA Ulrich. Genotype: Chilotrypa hispida Ulrich.

34. Cheilotrypa. Ulrich, Jour. Cincinnati Soc. Nat. Hist., VII, p. 49.

39. Chilotrypa. Miller, North American Geol. Pal., p. 297.

90. Chilotrypa. Ulrich, Geol. Surv. Illinois, VIII, p. 382.

96. Chilotrypa. Ulrich, Zittel's Textb. Pal. (Engl. ed.), p. 269.

97. Chilotrypa. Simpson, Fourteenth Ann. Rep. State Geologist New York for the year 1894, p. 554.

rypa camerata (Hall).

83. Trematopora camerata. Hall, Rep. State Geologist New York for the year 1882, pl. (26) xxiv, 9, 10.

87. Diamesopora camerata. Hall and Simpson, Pal. New York, VI, p. 72, pl. xxvi, 9, 10.

97. Diamesopora camerata. Simpson, Fourteenth Ann. Rep. State Geologist New York for the year 1894, pl. xvi, 3–5.

Upper Helderberg: Near Caledonia, New York.

rypa ? coalescens (Hall).

52. Trematopora coalescens. Hall, Pal. New York, II, p. 150, pl. xlA, 2*a*, *b*.

Niagara: Lockport, New York.

Chilotrypa constricta (Hall).

1874. Trematopora constricta. Hall, Twenty-sixth Ann. Rep. Ne Mus., p. 104.

1879. Trematopora ? constricta. Hall, Thirty-second Ann. Rep. N Mus., p. 150 (reprint, 1880, p. 12).

1883. Trematopora ? constricta. Hall, Rep. State Geologist New year 1882, pl. x, 14–19.

1887. Diamesopora constricta. Hall and Simpson, Pal. New Yor x, 14–19, pl. xxiiiA, 7.

Lower Helderberg: Clarksville, New York.

Obs. See also Chilotrypa dispersa (Hall).

Chilotrypa dispersa (Hall).

1879. Trematopora dispersa. Hall, Thirty-second Ann. Rep. Ne Mus., p. 150 (reprint, 1880, p. 12).

1883. Trematopora dispersa. Hall, Rep. State Geologist New Yor 1882, pl. x, 20, 21.

1887. Diamesopora dispersa. Hall and Simpson, Pal. New York, 20, 21.

Lower Helderberg: Clarksville, New York.

Obs. The form is probably a synonym for Chilotrypa cons

Chilotrypa hispida (Ulrich).

1884. Cheilotrypa hispida. Ulrich, Jour. Cincinnati Soc. Nat. Hi pl. iii, 6–6*d*.

Chester: Sloans Valley, Grayson Springs, and Stephenspo Chester and many other localities in Illinois.

Chilotrypa ostiolata (Hall).

1852. Trematopora ostiolata. Hall, Pal. New York, II, p. 152, pl.

1875. Trematopora ostiolata. Nicholson, Pal. Province Ontario, (Perhaps not the same form.)

1884. Cheilotrypa ostiolata. Ulrich, Jour. Cincinnati Soc. Nat. Hi 7, 7*a*.

1897. Chilotrypa ostiolata. Simpson, Fourteenth Ann. Rep. State York for the year 1894, pl. xxi, 1, 2.

Niagara: Lockport and Rochester, New York; Hamilton River, Ontario.

Chilotrypa varia (Hall).

1876. Trematopora varia. Hall, Twenty-eighth Ann. Rep. New Y (documentary edition), pl. x, 15–23; ibid. (Museum edition pl. x, 15–23.

1882. Trematopora varia. Hall, Eleventh Ann. Rep. Indiana Ge p. 232, pl. ix, 15–23.

1890. Diamesopora varia. Ulrich, Geol. Surv. Illinois, VIII, p. 46

Niagara: Waldron, Indiana.

Chilotrypa variolata (Hall).

1876. Trematopora variolata. Hall, Twenty-eighth Ann. Rep. Ne Mus. (documentary edition), pl. xi, 9, 10; ibid. (Museum p. 113, pl. xi, 9, 10.

1882. Trematopora variolata. Hall, Eleventh Ann. Rep. Indiana G p. 234, pl. x, 9, 10.

Niagara: Waldron, Indiana.

HROPORA Hall. Genotype: Clathropora frondosa Hall.
52. Clathropora. Hall, Pal. New York, II, p. 159.
74. Clathropora. Nicholson, Geol. Mag., dec. 2, I, p. 124.
74. Clathropora. Nicholson, Pal. Province Ontario, p. 111.
32. Clathropora. Ulrich, Jour. Cincinnati Soc. Nat. Hist., V, p. 152.
34. Clathropora. Ulrich, Jour. Cincinnati Soc. Nat. Hist., VII, p. 39.
37. Clathropora. Foerste, Bull. Sci. Lab. Denison Univ., II, p. 153.
39. Clathropora. Miller, North American Geol. Pal., p. 297.
90. Clathropora. Ulrich, Geol. Surv. Illinois, VIII, p. 392.
96. Clathropora. Ulrich, Zittel's Textb. Pal. (Engl. ed.), p. 279.
97. Clathropora. Simpson, Fourteenth Ann. Rep. State Geologist New York for the year 1894, p. 543.

opora ? alcicornis Hall.
52. Clathropora alcicornis. Hall, Pal. New York, II, p. 159, pl. xlB, *4a–c*.
Niagara: Lockport, New York.

ropora carinata Hall. See Coscinium cribriforme (Prout).

ropora clintonensis Hall and Whitfield. See Clathropora frondosa-tonensis Hall and Whitfield.

ropora flabellata Hall. See Stictoporella flabellata (Hall).

opora frondosa Hall.
52. Clathropora frondosa. Hall, Pal. New York, II, p. 160, pl. xlB, *5a–e*.
74. Clathropora frondosa. Nicholson and Hinde, Canadian Jour., new ser., XIV, p. 139.
75. Clathropora frondosa. Nicholson, Pal. Province Ontario, p. 59.
32. Clathropora frondosa. (Van Cleve) White, Eleventh Ann. Rep. Indiana Geol. Nat. Hist., p. 385, pl. lv, 3.
37. Clathropora frondosa. Foerste, Bull. Sci. Lab. Denison Univ., II, p. 154; ibid., III, 1888, pl. xv, 3.
39. Clathropora frondosa. Miller, North American Geol. Pal., fig. 467 (p. 297).
95. Clathropora frondosa. Foerste, Geol. Surv. Ohio, VII, p. 598, pl. xxviii, 3.
97. Clathropora frondosa. Simpson, Fourteenth Ann. Rep. State Geologist New York for the year 1894, fig. 104 (p. 544).
Clinton: Dayton and Centerville, Ohio.
Niagara: Lockport, New York; Thorold, Ontario.

opora frondosa-clintonensis Hall and Whitfield.
75. Clathropora clintonensis. Hall and Whitfield, Pal. Ohio, II, p. 113, pl. v, 7.
37. Clathropora clintonensis. Foerste, Bull. Sci. Lab. Denison Univ., II, p. 154; ibid., III, 1888, pl. xv, 4.
95. Clathropora clintonensis. Foerste, Geol. Surv. Ohio, VII, p. 598, pl. xxviii, 4.
Clinton: Dayton and Fair Haven, Ohio.

ropora ? gracilis Spencer. Not recognizable.
34. Clathropora ? gracilis. Spencer, Trans. St. Louis Acad. Sci., IV, p. 604. pl. vii, 4.
34. Clathropora ? gracilis. Spencer, Bull. Mus. State Univ. Missouri, I, p. 54, pl. vii, 4.
Niagara: Hamilton, Ontario.

opora intermedia Nicholson and Hinde.
74. Clathropora intermedia. Nicholson and Hinde, Canad. Jour., new ser., XIV, p. 140, fig. 5.

Clathropora intermedia Nicholson and Hinde—Continued.
1875. Clathropora intermedia. Nicholson, Pal. Province Ontario
Niagara: Thorold, Ontario.

Clathropora intertexta Nicholson.
1874. Clathropora intertexta. Nicholson, Geol. Mag., new ser.,
1874. Clathropora intertexta. Nicholson, Pal. Province Ontario
1875. Clathropora intertexta. Nicholson, Pal. Province Ontario
1859. Coscinium cyclops. Prout (not Keyserling), Trans. St.
I, p. 268.
Upper Helderberg (Hamilton ?): Port Jarvis, Ontario;
Columbus, Ohio.

Clathropora striatura Hall. See Coscinium striaturum (

CLONOPORA Hall. Genotype: Clonopora semireducta H
1883. Clonopora. Hall, Trans. Albany Institute, X, p. 162 (abst
1887. Clonopora. Hall and Simpson, Pal. New York, VI, p. x
1889. Clonopora. Miller, North American Geol. Pal., p. 298.
1897. Clonopora. Simpson, Fourteenth Ann. Rep. State Geol
for the year 1894, p. 598.

Clonopora fasciculata Hall and Simpson.
1887. Clonopora fasciculata. Hall and Simpson, Pal. New Yor
lxvi, 1, 2.
Upper Helderberg: Onondaga Valley, New York.

Clonopora incurva Hall.
1883. Clonopora incurva. Hall, Trans. Albany Institute, X,
1881, p. 20).
1887. Clonopora incurva. Hall and Simpson, Pal. New York
lxvi, 5, 6.
1897. Clonopora incurva. Simpson, Fourteenth Ann. Rep. Stat
York for the year 1894, pl. xxv, 6.
Upper Helderberg: Manlius, New York.

Clonopora semireducta Hall.
1883. Clonopora semireducta. Hall, Trans. Albany Institute,
stract, 1881, p. 20).
1887. Clonopora semireducta. Hall and Simpson, Pal. New Y
pl. lxvi, 3, 4.
1897. Clonopora semireductus. Simpson, Fourteenth Ann. Rep.
New York for the year 1894, pl. xxv, 7.
Hamilton: Falls of the Ohio.

CŒLOCAULIS Hall and Simpson. Genotype: Callopora
1887. Cœlocaulis (n. s. g.). Hall and Simpson, Pal. New York,
1889. Cœlocaulis. Miller, North American Geol. Pal., p. 298.
1897. Cœlocaulis. Simpson, Fourteenth Ann. Rep. State Geol
for the year 1894, p. 554.

Cœlocaulis ?? aculeolata (Hall).
1883. Callopora aculeolata. Hall, Trans. Albany Institute, X,
1881, p. 7).
1883. Callopora aculeolata. Hall, Rep. State Geologist New Y
1882, pl. (26) xxiv, 16, 17.
1887. Callopora (Cœlocaulis) aculeolata. Hall and Simpson,
VI, p. 76, pl. xxvi, 16, 17.
Upper Helderberg: New York.

caulis ?? hyale (Hall).

874. Callopora Hyale. Hall, Twenty-sixth Ann. Rep. New York State Mus., p. 100.

879. Callopora Hyale. Hall, Thirty-second Ann. Rep. New York State Mus., p. 155 (reprint, 1880, p. 17).

883. Callopora Hyale. Hall, Rep. State Geologist New York for the year 1882, pl. xii, 18, 19.

887. Callopora (Cœlocaulis) Hyale. Hall and Simpson, Pal. New York, VI, p. 76, pl. xii, 18, 19.

Upper Helderberg: Central New York.

Obs. This is probably a parasitic species of Fistulipora.

caulis ? irregularis (Hall).

883. Callopora irregularis. Hall, Trans. Albany Institute, X, p. 148 (abstract, 1881, p. 7).

883. Trematopora (Callopora) irregularis. Hall, Rep. State Geologist New York for the year 1882, pl. (26) xxiv, 11–15.

887. Callopora (Cœlocaulis) irregularis. Hall and Simpson, Pal. New York, VI, p. 76, pl. xxvi, 11–15.

Upper Helderberg: New York.

caulis ? mediopora (Hall).

879. Callopora parasitica (in part). Hall, Thirty-second Ann. Rep. New York State Mus., p. 157 (reprint, 1880, p. 19).

883. Callopora parasitica (in part). Hall, Rep. State Geologist New York for the year 1882, pl. xiv, 18.

887. Callopora (Cœlocaulis) mediopora. Hall and Simpson, Pal. New York, VI, p. 23, pl. xiv, 18, pl. xxiii A, 11–13.

Lower Helderberg: Near Clarksville, New York.

caulis venusta (Hall).

874. Callopora venusta. Hall, Twenty-sixth Ann. Rep. New York State Mus., p. 101.

879. Callopora venusta. Hall, Thirty-second Ann. Rep. New York State Mus., p. 155 (reprint, 1880, p. 17).

883. Callopora venusta. Hall, Rep. State Geologist New York for the year 1882, pl. xii, 20–24.

887. Callopora (Cœlocaulis) venusta. Hall and Simpson, Pal. New York, VI, p. 23, pl. xii, 20–24; pl. xxiii A, 1–3, ? 4, 5.

897. Cœlocaulis venusta. Simpson, Fourteenth Ann. Rep. State Geologist New York for the year 1894, pl. xxi, 3–5.

Lower Helderberg: Clarksville, New York.

OCLEMA Ulrich. Genotype: Diamesopora vaupeli Ulrich = Ceraopora alternata James.

882. Cœloclema. Ulrich, Jour. Cincinnati Soc. Nat. Hist., V, p. 137; ibid., VII, 1884, p. 49. (Not defined.)

890. Diamesopora (in part). Ulrich, Geol. Surv. Illinois, VIII, pp. 380, 467.

893. Diamesopora (in part). Ulrich, Geol. Minnesota, III, p. 330.

896. Diamesopora. Ulrich, Zittel's Textb. Pal. (Eng. ed.), p. 268.

Obs. Cœloclema Ulrich (not defined) was abandoned in favor of Diamesopora Hall, under the mistaken belief that Diamesopora dichotoma Hall was congeneric with the D. vaupeli Ulrich. As our generic diagnoses show, the two genera are not at all related.

clema alternatum (James).

1878. Ceramopora alternata. James, Paleontologist, No. 1, p. 5.

Cœloclema alternatum (James)—Continued.

1888. Monticulipora (Fistulipora) alternata. James and James, Jour. Cincinnati Soc. Nat. Hist., XI, p. 34, pl. i, 5–5*b*.

1890. Diamesopora vaupeli. Ulrich, Geol. Surv. Illinois, VIII, p. 468, pl. xxxix, 3, 3*b*, pl. xli, 4–4*c*.

Cincinnati (Utica): Cincinnati, Ohio, and vicinity.

Cœloclema concentricum (James).

1878. Ceramopora concentrica. James, Paleontologist, No. 1, p. 5.

1888. Ceramopora concentrica. James and James, Jour. Cincinnati Soc. Nat. Hist., XI, p. 38, pl. i, 8, 8*a*.

1890. Diamesopora communis. Ulrich, Geol. Surv. Illinois, VIII, p. 469, pl. xxxix, 3*a*, pl. xli, 5–5*b*.

Cincinnati (Utica): Cincinnati, Ohio, and vicinity.

Cœloclema imbricata Ulrich. See Diamesopora subimbricata (Hall).

Cœloclema infrequens Ulrich. See Diamesopora infrequens (Hall).

Cœloclema osculum Ulrich. See Diamesopora osculum (Hall).

Cœloclema oweni (James).

1884. Fistulipora oweni. James, Jour. Cincinnati Soc. Nat. Hist., VII, p. 21, fig. 2–2*g*.

1888. Monticulipora (Fistulipora) oweni. James and James, Jour. Cincinnati Soc. Nat. Hist., XI, p. 34.

1890. Diamesopora oweni. Ulrich, Geol. Surv. Illinois, VIII, p. 467.

1896. Monticulipora (Fistulipora) oweni. J. F. James, Jour. Cincinnati Soc. Nat. Hist., XVIII, p. 119.

Cincinnati (Lorraine): Lebanon, Hamilton, and Cincinnati, Ohio.

Cœloclema trentonense (Ulrich).

1893. Diamesopora trentonensis. Ulrich, Geol. Minnesota, III, p. 330, pl. xxviii, 14.

1896. Diamesopora trentonensis. Ulrich, Zittel's Textb. Pal. (Engl. ed.), fig. 439 (p. 268).

Trenton: St. Paul and Cannon Falls, Minnesota; Trenton Falls, New York; Ottawa, Canada.

CŒLOCONUS Ulrich. Genotype: Cœloconus rhombicus Ulrich.

1890. Cœloconus. Ulrich, Geol. Surv. Illinois, VIII, pp. 402, 664.

1889. Cœloconus. (Ulrich, in press), Miller, North American Geol. Pal., p. 298.

1896. Cœloconus. Ulrich, Zittel's Textb. Pal. (Engl. ed.), p. 281.

1897. Cœloconus. Simpson, Fourteenth Ann. Rep. State Geologist New York for the year 1894, p. 549.

Cœloconus granosus Ulrich.

1890. Cœloconus granosus. Ulrich, Geol. Surv. Illinois, VIII, p. 665, pl. lxxii, 3–3*b*.

1897. Cœloconus granosus. Simpson, Fourteenth Ann. Rep. State Geologist New York for the year 1894, fig. 117 (p. 549).

Chester: Anna, Chester, and Red Bud, Illinois.

Cœloconus rhombicus Ulrich.

1890. Cœloconus rhombicus. Ulrich, Geol. Surv. Illinois, VIII, p. 664, pl. lxxii, 4–4c.

1897. Cœloconus rhombicus. Simpson, Fourteenth Ann. Rep. State Geologist New York for the year 1894, fig. 118 (p. 549).

Warsaw: Near Waterloo, Illinois.

TELLARIA Dana. Genotype: Ceriopora constellata (Van Cleve s.)) Dana.

6. Constellaria. Dana, Zoophyta, p. 537.
5. Constellaria. Nicholson, Pal. Ohio, II, p. 214.
9. Constellaria. Nicholson, Pal. Tab. Corals, p. 292.
1. Constellaria. Nicholson, Genus Monticulipora, p. 97.
2. Constellaria. Ulrich, Jour. Cincinnati Soc. Nat. Hist., V, p. 156.
3. Constellaria. Ulrich, Jour. Cincinnati Soc. Nat., Hist., VI, p. 265.
8. Constellaria. James and James, Jour. Cincinnati Soc. Nat. Hist., XI, p. 29.
0. Constellaria. Ulrich, Geol. Surv. Illinois, VIII, pp. 374, 423.
3. Constellaria. Ulrich, Geol. Minnesota, III, p. 311.
6. Constellaria. Ulrich, Zittel's Textb. Pal. (Engl. ed.), p. 276.
6. Constellaria. J. F. James, Jour. Cincinnati Soc. Nat. Hist., XVIII, p. 117.
0. Stellipora. Milne-Edwards, Hist. Nat. des Corall., III, p. 281.
7. Stellipora (in part). Dybowski, Die Chæteiden d. Ostbalt. Silur-Form., p. 42.

ellaria antheloidea of various authors (not Hall). See Constel- constellata (Van Cleve) Dana.

llaria constellata (Van Cleve) Dana.

–. Ceriopora constellata. Van Cleve (Mss.), Plates of Fossils.
6. Constellaria constellata. Dana, Zoophyta, p. 537, pl. lii, 6*a*, *b*.
1. Chætetes constellatus. Quenstedt, Roehren- und Sternkorallen, p. 79, pl. cxlvi, 21–25.
0. Stellipora antheloidea (not of Hall). D'Orbigny, Prodr. de Pal., I, p. 22.
1. Constellaria antheloidea (not of Hall). Milne-Edwards and Haime, Pol. Foss. Terr. Pal., p. 279, pl. xx, 7, 7*b*.
0. Stellipora antheloidea (not of Hall). Milne-Edwards, Hist. Nat. des Corall., III, p. 281.
6. Hellipora (Constellaria) antheloidea (not of Hall). Rominger, Proc. Acad. Nat. Sci. Philadelphia, p. 118.
5. Constellaria antheloidea (not of Hall). Nicholson, Pal. Ohio, II, p. 214.
6. Constellaria antheloidea (not of Hall). Nicholson, Ann. Mag. Nat. Hist., ser. 4, XVIII, p. 92, pl. v, 10.
8. Constellaria antheloidea (not of Hall). James, Paleontologist, No. 2, p. 13.
9. Constellaria antheloidea (not of Hall). Nicholson, Pal. Tab. Corals, p. 301, pl. xiv, 5, 5*b*.
2. Constellaria antheloidea (not of Hall). (Van Cleve) White, Eleventh Ann. Rep. Indiana Geol. Nat. Hist., p. 379, pl. xlvi, 1–3.
2. Constellaria florida. Ulrich, Jour. Cincinnati Soc. Nat. Hist., V, p. 257; ibid., VI, 1883, p. 267, pl. xiv, 2–2*f*.
6. Constellaria florida. Ulrich, Zittel's Textb. Pal. (Engl. ed.), fig. 461 (p. 276).
8. Monticulipora (Constellaria) polystomella (not of Nicholson), (in part). James and James, Jour. Cincinnati Soc. Nat. Hist., XI, p. 30.
6. Monticulipora (Constellaria) polystomella (not of Nicholson), (in part). J. F. James, Jour. Cincinnati Soc. Nat. Hist., XVIII, p. 118.

Cincinnati (Lorraine): Cincinnati, Ohio. A common fossil in the Lorraine beds of Ohio, Indiana, Kentucky, and Tennessee.

llaria constellata-plana Ulrich.

3. Constellaria florida var. plana. Ulrich, Jour. Cincinnati Soc. Nat. Hist., VI, p. 269, pl. xiv, 4.

Cincinnati (Lorraine): Cincinnati, Ohio, and vicinity.

Constellaria constellata-prominens Ulrich.

1883. Constellaria florida var. prominens. Ulrich, Jour. Cinci
Hist., VI, p. 269, pl. xiv, 3.
Cincinnati (Utica and Lorraine): Cincinnati, Ohio, and v

Constellaria fischeri Ulrich.

1883. Constellaria fischeri. Ulrich, Jour. Cincinnati Soc. Nat.
pl. xiv, 6–6c.
Trenton: Winchester, Kentucky; Nashville, Tennessee.
locality are given erroneously with the description.

Constellaria florida Ulrich. See Constellaria constellat
Dana.

Constellaria florida var. plana Ulrich. See Constellari
plana Ulrich.

Constellaria florida var. prominens Ulrich. See Constel
lata-prominens Ulrich.

Constellaria limitaris (Ulrich).

1879. Stellipora limitaris. Ulrich, Jour. Cincinnati Soc. Nat.
pl. xii, 8–8*c*.

1883. Constellaria limitaris. Ulrich, Jour. Cincinnati Soc. N
269, pl. xiv, 5, 5*a*.
Cincinnati (Richmond): Clarksville, Blanchester, Wayne
localities in Ohio; Versailles and Weisburg, Indiana.

Constellaria parva Ulrich.

1890. Constellaria parva. Ulrich, Geol. Surv. Illinois, VIII, p
1–1*b*.

1896. Monticulipora (Constellaria) parva. J. F. James, Jour.
Nat. Hist. XVIII, p. 119.
Cincinnati (Richmond): Wilmington, Illinois.

Constellaria polystomella Nicholson.

1875. Constellaria polystomella. Nicholson, Pal. Ohio, II, p. 21

1882. Constellaria polystomella. Whitfield, Geol. Surv. Wisco
pl. xii, 3, 4.

1896. Monticulipora (Constellaria) polystomella (in part). J.
Cincinnati Soc. Nat. Hist., XVIII, p. 118.
Cincinnati (Richmond): Delafield, Wisconsin; Wilmi
Richmond and Versailles, Indiana; Blanchester, W
other localities in Ohio.
Obs. Nicholson erroneously records this characteristic fo
mond beds as from Cincinnati, Ohio.

Constellaria punctata (Whitfield).

1878. Monticulipora punctata. Whitfield, Ann. Rep. Wiscon
for 1887, p. 71.

1882. Monticulipora punctata. Whitfield, Geol. Surv. Wiscon
pl. xi, 3, 4.
Cincinnati (Richmond): Delafield and Iron Ridge, Wisco

Constellaria varia Ulrich.

1893. Constellaria varia. Ulrich, Geol. Minnesota, III, p. 311,
Trenton: Cannon Falls, Minnesota; Belleville, Canada; Be

CINELLA Hall and Simpson. Genotype: Coscinella elegantula Hall and Simpson.

1887. Coscinella. Hall and Simpson, Pal. New York, VI, p. xix.
1889. Coscinella. Miller, North American Geol. Pal., p. 298.
1897. Coscinella. Simpson, Fourteenth Ann. Rep. State Geologist New York for the year 1894, p. 534.

Obs. Ulrich unites this genus with Intrapora. It seems better to hold it for forms agreeing with Intrapora in zoœcial structure, but differing in the mode of growth by forming a regular network of anastomosing branches with rounded fenestrules.

cinella cosciniformis (Nicholson).

1875. Ptilodictya cosciniformis. Nicholson, Geol. Mag., new ser., II, p. 35, pl. ii, 2–2*b*.
1875. Ptilodictya cosciniformis. Nicholson, Pal. Province Ontario, p. 80, pl. ii, 2*a*, 2*b*.
1887. Coscinium cosciniforme. Hall and Simpson, Pal. New York, VI, p. 239.
Hamilton: Arkona, Ontario.
1889. Coscinella cosciniformis. Miller, North American Geol. Pal., p. 298.
1890. Intrapora cosciniformis. Ulrich, Geol. Surv. Illinois, VIII, p. 532, pl. xliii, 6, 6*a*.
1898. Intrapora cosciniformis. Whiteaves, Contr. Canad. Pal., I, p. 376.

cinella elegantula Hall and Simpson.

1887. Coscinella elegantula. Hall and Simpson, Pal. New York, VI, p. 239, pl. lxiv, 9–12.
1897. Coscinella elegantula. Simpson, Fourteenth Ann. Rep. State Geologist New York for the year 1894, pl. xiv, 7–12.
1898. Intrapora elegantula. Whiteaves, Contr. Canad. Pal., I, p. 376.
Hamilton: Widder, Ontario.

CINIUM Keyserling. Genotype: Coscinium cyclops Keyserling.

1846. Coscinium. Keyserling, Reise in das Petschora Land, p. 191.
1858. Coscinium. Prout, Trans. St. Louis Acad. Sci., I, p. 266.
1860. Coscinium. Eichwald, Lethæa Rossica, I, p. 397.
1884. Coscinium. Ulrich, Jour. Cincinnati Soc. Nat. Hist., VII, p. 38.
1887. Coscinium. Hall and Simpson, Pal. New York, VI, p. xix.
1889. Coscinium. Miller, North American Geol. Pal., p. 298.
1890. Coscinium. Ulrich, Geol. Surv. Illinois, VIII, pp. 385, 496.
1897. Coscinium. Simpson, Fourteenth Ann. Rep. State Geologist New York for the year 1894, p. 537.
1887. Coscinotrypa. Hall and Simpson, Pal. New York, VI, p. xix.
1889. Coscinotrypa. Miller, North American Geol. Pal., p. 298.
1897. Coscinotrypa. Simpson, Fourteenth Ann. Rep. State Geologist New York for the year 1894, p. 537.

cinium asterias Prout. See Fistulipora asteria (Prout).

scinium cosciniforme Hall and Simpson. See Coscinella cosciniformis (Nicholson).

cinium cribriforme Prout.

1859. Coscinium cribriformis. Prout, Trans. St. Louis Acad Sci., I, p. 269, pl. xvi, 1, 1*a*.
1890. Coscinium cribriforme. Ulrich, Geol. Surv. Illinois, VIII, p. 496, pl. xliii, 8.
1897. Coscinotrypa cribriformis. Simpson, Fourteenth Ann. Rep. State Geologist New York for the year 1894, pl. xiii, 1–7.

Coscinium cribriforme Prout—Continued.

1884. Coscinium cyclops (not of Keyserling). Ulrich, Jour. Cincinnati Soc. Nat. Hist., VII, p. 38, pl. ii, 6.

1883. Clathropora carinata. Hall, Rep. State Geologist New York for the year 1882, pl. xxvi, 22–25.

1886. Coscinotrypa carinata. Hall, Fifth Ann. Rep. State Geologist New York for the year 1885, pl. xxix, 29–35.

1887. Coscinotrypa cribriformis var. carinata. Hall and Simpson, Pal. New York, VI, p. 89, pl. xxix, 29–35, pl. xxxiii, 22–25.

Hamilton: Falls of the Ohio; Utica, Indiana.

Coscinium cyclops Prout (not Keyserling). See Clathropora intertexta Nicholson.

Coscinium cyclops Ulrich (not Keyserling). See Coscinium cribriforme Prout.

Coscinium dictyotum (Meek).

1873. Ptilodictya (Stictopora?) dictyota. Meek, Hayden's Sixth Ann. Rep. U. S. Geol. Surv., p. 465.

Carboniferous: Mystic Lake, Montana.

Coscinium elegans Prout. See Glyptopora elegans (Prout).

Coscinium escharense Prout. Not recognizable.

1859. Coscinium escharense. Prout, Trans. St. Louis Acad. Sci., I, p. 574.

1866. Coscinium escharense. Prout, Geol. Surv. Illinois, II, p. 416, pl. xxii, 8, 8*a*.

1884. Lichenalia escharense. Ulrich, Jour. Cincinnati Soc. Nat. Hist., VII, p. 40.

Keokuk: Warsaw, Illinois.

Coscinium keyserlingi Prout. See Glyptopora keyserlingi (Prout).

Coscinium latum Ulrich.

1890. Coscinium latum. Ulrich, Geol. Surv. Illinois, VIII, p. 497, pl. lxxvi, 7–7*b*.

1894. Coscinium? latum. Keyes, Missouri Geol. Surv., V, p. 18.

Burlington: Calhoun County and Quincy, Illinois; Burlington, Iowa.

Coscinium Michelinia Prout. See Glyptopora michelinia (Prout).

Coscinium plumosum Prout. See Glyptopora plumosa (Prout) and Glyptopora sagenella-caliculosa Ulrich.

Coscinium saganella Prout. See Glyptopora sagenella (Prout).

Coscinium striatum Hall and Simpson.

1887. Coscinium striatum. Hall and Simpson, Pal. New York, VI, p. 238, pl. lxiv, 13–16.

1897. Coscinium striatum. Simpson, Fourteenth Ann. Rep. State Geologist New York for the year 1894, pl. xiii, 8–12.

1898. Coscinium striatum. Whiteaves, Contr. Canad. Pal., I, Part V, p. 377.

Hamilton: Widder, Ontario.

Coscinium striaturum (Hall).

1883. Clathropora striatura. Hall, Rep. State Geologist New York for the year 1882, pl. (33) xxvi, 20, 21.

1887. Coscinium striaturum. Hall and Simpson, Pal. New York, VI, p. 88, pl. xxxiii, 20, 21.

1897. Coscinium striaturum. Simpson, Fourteenth Ann. Rep. State Geologist New York for the year 1894, pl. xiv, 1.

Upper Helderberg: Stafford, New York.

Coscinium tuberculatum Prout. See Fistulipora? tuberculata (Prout).

nium wortheni Prout.

60. Coscinium Wortheni. Prout, Trans. St. Louis Acad. Sci., I, p. 571.
66. Coscinium Wortheni. Prout, Geol. Surv. Illinois, II, p. 412, pl. xxii, 1.
Keokuk: Near Warsaw, Illinois.
Obs. If recognizable at all, probably an abnormal example of Glyptopora keyserlingi (Prout).

notrypa Hall. See Coscinium Keyserling.

notrypa carinata Hall. See Coscinium cribriforme Prout.

notrypa cribriformis Simpson. See Coscinium cribriforme Prout.

notrypa cribriformis var. carinata Hall. See Coscinium cribriforme Prout.

ripora Ulrich.

79. Crateripora. Ulrich, Jour. Cincinnati Soc. Nat. Hist., II, p. 29.
Obs. The forms for which this genus was proposed have been found to be the basal articulating sockets of species of Escharopora and Arthropora.

ripora erecta Ulrich. See Arthropora shafferi (Meek).

ripora lineata Ulrich. See Escharopora falciformis (Nicholson).

ripora lineata var. expansa Ulrich. See Escharopora falciformis cholson).

IPORA Ulrich. Genotype: Crepipora simulans Ulrich.

82. Crepipora. Ulrich, Jour. Cincinnati Soc. Nat. Hist., V, p. 157.
89. Crepipora. Miller, North American Geol. Pal., p. 299.
90. Crepipora. Ulrich, Geol. Surv. Illinois, VIII, pp. 380, 469.
93. Crepipora. Ulrich, Geol. Minnesota, III, p. 322.
96. Crepipora. Ulrich, Zittel's Textb. Pal. (Engl. ed.), p. 268.
97. Crepipora. Simpson, Fourteenth Ann. Rep. State Geologist New York for the year 1894, p. 566.

ipora epidermata Ulrich. See Bythotrypa epidermata (Ulrich).

pora hemispherica Ulrich.

90. Crepipora hemispherica. Ulrich, Geol. Surv. Illinois, VIII, p. 472, pl. xl, 5–5*b*.
Cincinnati (Richmond): Wilmington, Illinois; Delafield, Wisconsin.

ipora impolita Ulrich. See Anolotichia impolita (Ulrich).

pora impressa Ulrich.

90. Crepipora impressa. Ulrich, Geol. Surv. Illinois, VIII, p. 471, pl. xl, 2, 2*a*.
97. Crepipora impressa. Simpson, Fourteenth Ann. Rep. State Geologist New York for the year 1894, figs. 135, 136 (p. 566).
Cincinnati (Lorraine): Covington, Kentucky.

pora perampla Ulrich.

93. Crepipora perampla. Ulrich, Geol. Minnesota, III, p. 323, pl. xxviii, 29–32.
96. Crepipora perampla. Ulrich, Zittel's Textb. Pal. (Engl. ed.), fig. 436A–C (p. 267).
Trenton (Stones River): Chatfield and Spring Valley, Minnesota.

pora simulans Ulrich.

90. Crepipora simulans. Ulrich, Geol. Surv. Illinois, VIII, p. 470, pl. xxxix, 4, 4*a*, pl. xl, 3, 3*a*; fig. 8*b* (p. 320).
89. Crepipora simulans. (Ulrich, in press), Miller, North American Geol. Pal., fig. 468 (p. 299).

Crepipora simulans Ulrich—Continued.

1896. Crepipora simulans. Ulrich, Zittel's Textb. Pal. (Engl. ed.), fig. 436D (p. 267).

1897. Crepipora simulans. Simpson, Fourteenth Ann. Rep. State Geologist New York for the year 1894, figs. 133, 134 (p. 566).

Cincinnati (Lorraine): Cincinnati, Ohio, and vicinity. A rather common species in the Lorraine beds of Ohio, Indiana, Kentucky, and Tennessee. The same species or closely related varieties occur in the Trenton of Kentucky and Tennessee, and in the Richmond of Ohio, Indiana, Illinois, Wisconsin, and Kentucky.

Crepipora solida Ulrich.

1890. Crepipora solida. Ulrich, Geol. Surv. Illinois, VIII, p. 472, pl. xl, 4–4*b*.

Cincinnati (Utica): Covington, Kentucky.

Crepipora spatiosa Ulrich.

1893. Crepipora spatiosa. Ulrich, Geol. Minnesota, III, p. 323.

Trenton: Harrodsburg and Frankfort, Kentucky.

Crepipora subæquata Ulrich.

1893. Crepipora subæquata. Ulrich, Geol. Minnesota, III, p. 322, pl. xxviii, 26–28.

Trenton (Black River): St. Paul, Minnesota.

Crepipora venusta (Ulrich).

1878. Chætetes venustus. Ulrich, Jour. Cincinnati Soc. Nat. Hist., I, p. 93, pl. iv, 7, 7*a*.

1882. Crepipora venusta. Ulrich, Jour. Cincinnati Soc. Nat. Hist., V, p. 257.

1888. Monticulipora (Fistulipora) venusta. James and James, Jour. Cincinnati Soc. Nat. Hist., XI, p. 33.

Trenton and Cincinnati (Utica): Covington and Newport, Kentucky; Cincinnati, Ohio.

Crisina ? scrobiculata Hall. See Crisinella scrobiculata (Hall).

CRISINELLA Hall. Genotype: Crisina ? scrobiculata Hall.

1883. Crisinella. Hall, Rep. State Geologist New York for the year 1882, expl. pl. (33) xxvi.

1887. Crisinella. Hall and Simpson, Pal. New York, VI, p. xxv.

1889. Crisinella. Miller, North American Geol. Pal., p. 299.

1897. Crisinella. Simpson, Fourteenth Ann. Rep. State Geologist New York for the year 1894, p. 526.

Crisinella scrobiculata (Hall).

1883. Crisina ? scrobiculata. Hall, Trans. Albany Institute, X, p. 162 (abstract, 1881, p. 20).

1883. Crisinella scrobiculata. Hall, Rep. State Geologist New York for the year 1882, pl. (33) xxvi, 6–8.

1887. Crisinella scrobiculata. Hall and Simpson, Pal. New York, VI, p. 103, pl. xxxiii, 6–8.

1897. Crisinella scrobiculata. Simpson, Fourteenth Ann. Rep. State Geologist New York for the year 1894, pl. ix, 1–3.

Upper Helderberg: Western New York.

Cryptopora Nicholson. See Semicoscinium Prout.

Cryptopora mirabilis Nicholson. See Semicoscinium mirabile (Nicholson).

CLOPORA Prout. Genotype: Cyclopora fungia Prout.
1860. Cyclopora. Prout, Trans. St. Louis Acad. Sci., I, p. 574.
1866. Cyclopora. Prout, Geol. Surv. Illinois, II, p. 417.
1889. Cyclopora. Miller, North American Geol. Pal., p. 299.
1890. Cyclopora. Ulrich, Geol. Surv. Illinois, VIII, pp. 403, 671.
1897. Cyclopora. Simpson, Fourteenth Ann. Rep. State Geologist New York for the year 1894, p. 601.

clopora discoidea Prout. See Proutella discoidea (Prout).

lopora expatiata Ulrich.
1890. Cyclopora expatiata. Ulrich, Geol. Surv. Illinois, VIII, p. 673, pl. lxviii, 4–4*d*.
1894. Cyclopora expatiata. Keyes, Missouri Geol. Surv., V, p. 37.
Keokuk: Warsaw and Nauvoo, Illinois.

lopora fungia Prout.
1860. Cyclopora fungia. Prout, Trans. St. Louis Acad. Sci., I, p. 577.
1866. Cyclopora fungia. Prout. Geol. Surv. Illinois, II, p. 419, pl. xxii, 9–9*b*.
1890. Cyclopora fungia. Ulrich, Geol. Surv. Illinois, VIII, p. 671, pl. lxviii, 3–3*g*.
1894. Cyclopora fungia. Keyes, Missouri Geol. Surv., V, p. 36.
1897. Cyclopora fungia. Simpson, Fourteenth Ann. Rep. State Geologist New York for the year 1894, figs. 210–213 (p. 601).
Keokuk and Warsaw: St. Francisville, Missouri (Prout); a common species at many localities in Illinois and Iowa.

clopora Jamesii Prout. See Escharopora pavonia (D'Orbigny).

clopora polymorpha Prout. See Stenopora tuberculata (Prout).

CLOPORELLA Ulrich. Genotype: Cycloporella spinifera Ulrich.
1890. Cycloporella. Ulrich, Geol. Surv. Illinois, VIII, pp. 404, 675.
1889. Cycloporella. (Ulrich, in press), Miller, North American Geol. Pal., p. 299.

loporella ? perversa Ulrich.
1890. Cycloporella ? perversa. Ulrich, Geol. Surv. Illinois, VIII, p. 676, pl. lxix, 3–3*b*.
1894. Cycloporella perversa. Keyes, Missouri Geol. Surv., V, p. 37.
Keokuk: Warsaw and Greene counties, Illinois; Bentonsport, Iowa.

loporella spinifera Ulrich.
1890. Cycloporella spinifera. Ulrich, Geol. Surv. Illinois, VIII, p. 675, pl. lxix, 1–1*c*.
1894. Cycloporella spinifera. Keyes, Missouri Geol. Surv., V, p. 37.
Keokuk: Warsaw, Illinois.

cloporina Simpson. See Semicoscinium Prout.

cloporina hemicycla Simpson. See Semicoscinium labiatum (Hall).

cloporina rhomboidea Simpson. See Semicoscinium semirotundum Hall).

cloporina semirotunda Simpson. See Semicoscinium semirotunum (Hall).

CLOTRYPA Ulrich. Genotype: Fistulipora communis Ulrich.
1890. Nov. gen. (?). Ulrich, Geol. Surv. Illinois, VIII, p. 382.
1896. Cyclotrypa. Ulrich, Zittel's Textb. Pal., (Engl. ed.), p. 269.

Cyclotrypa collina (Ulrich).

1890. Fistulipora collina. Ulrich, Geol. Surv. Illinois, VIII, p. 478, pl. xlvii pl. xlviii, 5, 5*a*.

1896. Cyclotrypa collina. Ulrich, Zittel's Textb. Pal. (Engl. ed.), p. 269.

Hamilton: Buffalo, Iowa.

Cyclotrypa communis (Ulrich).

1890. Fistulipora communis. Ulrich, Geol. Surv. Illinois, VIII, p. 476, pl. 1, 1*a*, pl. xlviii, 1, 1*a*.

1896. Cyclotrypa communis. Ulrich, Zittel's Textb. Pal. (Engl. ed.), f (p. 269).

Hamilton: Buffalo, Iowa; Rock Island, Illinois.

CYSTODICTYA Ulrich. Genotype: Cystodictya ocellata Ulrich.

1882. Cystodictya. Ulrich, Jour. Cincinnati Soc. Nat. Hist., V, pp. 152, 170

1884. Cystodictya. Ulrich, Jour. Cincinnati Soc. Nat. Hist., VII, p. 35.

1887. Cystodictya. Foerste, Bull. Sci. Lab. Denison Univ., II, p. 74.

1889. Cystodictya. Miller, North American Geol. Pal., p. 299.

1890. Cystodictya. Ulrich, Geol. Surv. Illinois, VIII, pp. 385, 491.

1896. Cystodictya. Ulrich, Zittel's Textb. Pal. (Engl. ed.), p. 280.

1897. Cystodictya. Simpson, Fourteenth Ann. Rep. State Geologist New for the year 1894, p. 536.

1883. Arcanopora. Vine, Fifty-third Rep. British Assoc. Adv. Sci., p. 204.

1887. Stictopora (not of Hall, 1847). Hall and Simpson, Pal. New Yor p. xx.

1897. Stictocella. Simpson, Fourteenth Ann. Rep. State Geologist New Yo the year 1894, p. 532.

Cystodictya americana Ulrich.

1890. Cystodictya americana. Ulrich, Geol. Surv. Illinois, VIII, p. 494, pl. 5, 5*a*.

1894. Cystodictya americana. Keyes, Missouri Geol. Surv., V, p. 17.

Keokuk: Kings Mountain, Kentucky; Bentonsport, Iowa.

Cystodictya angularis (Hall and Simpson).

1887. Stictopora angularis. Hall and Simpson, Pal. New York, VI, p. 2 lxi, 23.

1891. Stictopora angularis. Hall, Tenth Ann. Rep. State Geologist New for the year 1890, p. 46; Forty-fourth Ann. Rep. New York State p. 76.

Hamilton: Near Le Roy, New York.

Obs. Probably a synonym for Cystodicta tumulosa (Hall and Sim

Cystodictya angusta Ulrich.

1888. Cystodictya angusta. Ulrich, Bull. Denison Univ., IV, p. 82, pl. xiv,

Waverly: Moot's Run, Ohio.

Cystodictya bifurcata (Hall and Simpson).

1887. Stictopora bifurcata. Hall and Simpson, Pal. New York, VI, p. 2 lxiii, 17.

1891. Stictopora bifurcata. Hall, Tenth Ann. Rep. State Geologist New for the year 1890, p. 47; Forty-fourth Ann. Rep. New York State p. 77.

1889. Stictopora bristolensis. Miller, North American Geol. Pal., p. 323.

Hamilton: Near Muttonville, Ontario County, New York.

Cystodictya carbonaria (Meek).

1871. Ptilodictya (Stictopora) carbonaria. Meek, Proc. Acad. Nat. Sci. Ph phia, p. 160.

dictya carbonaria (Meek)—Continued.

375. Ptilodictya (Stictopora) carbonaria. Meek, Pal. Ohio, II, p. 328, pl. xx, 3*a*, *b*.

382. Cystodictya carbonaria. Ulrich, Jour. Cincinnati Soc. Nat. Hist., V, p. 171.

387. Cystodictya carbonaria. Foerste, Bull. Sci. Lab. Denison Univ., II, p. 74, pl. vii, 2*a*–*c*.

Coal Measures: Newark and Bald Hill, Ohio; Seville, Illinois.

dictya ? concentrica (Prout).

358. Eschara ? concentrica. Prout, Trans. St. Louis Acad. Sci., I, p. 234.

Carboniferous: Organ Mountains, New Mexico.

odictya crenulata Ulrich. See Cystodictya subrigida (Hall).

dictya crescens (Hall).

386. Stictopora crescens. Hall, Fifth Ann. Rep. State Geologist New York for the year 1885, pl. xxvii, 5–11.

387. Stictopora crescens. Hall and Simpson, Pal. New York, VI, p. 91, pl. xxvii, 5–11.

390. Cystodictya crescens. Ulrich, Geol. Surv. Illinois, VIII, p. 492.

397. Stictopora crescens. Simpson, Fourteenth Ann. Rep. State Geologist New York for the year 1894, pl. x, 9, 10.

Upper Helderberg: Ontario.

dictya gilberti (Meek).

371. Ptilodictya (Stictopora) Gilberti. Meek, Proc. Acad. Nat. Sci. Philadelphia, p. 63.

373. Ptilodictya (Stictopora) Gilberti. Meek, Pal. Ohio, I, p. 194, pl. xviii, 1*a*–*c*.

375. Ptilodictya Gilberti. Nicholson, Pal. Province Ontario, p. 80.

382. Cystodictya gilberti. Ulrich, Jour. Cincinnati Soc. Nat. Hist., V, p. 168. pl. viii, 2, 2*a*; ibid., VII, 1884, p. 36, pl. ii, 5–5*b*.

383. Stictopora Gilberti. Hall, Trans. Albany Institute, X, p. 155 (abstract, 1881, p. 13).

383. Stictopora Gilberti. Hall, Rep. State Geologist New York for the year 1882, pl. (28) xxv, 21, 22.

386. Stictopora Gilberti. Hall, Fifth Ann. Rep. State Geologist New York for the year 1885, pl. xxvii, 20–35.

387. Stictopora Gilberti. Hall and Simpson, Pal. New York, VI, p. 90, pl. xxvii, 20–35, pl. xxviii, 21, 22.

390. Cystodictya gilberti. Ulrich, Geol. Surv. Illinois, VIII, fig. 8*e* (p. 320), pl. xliii, 7.

97. Cystodictya gilberti. Simpson, Fourteenth Ann. Rep. State Geologist New York for the year 1894, pl. x, 12–17.

81. Stictopora crispata. Quenstedt, Roehren- und Sternkorallen, p. 173, pl. cl, 3*s*.

Upper Helderberg: Sylvania and Marblehead, Ohio (Meek); Jarvis, Ontario, (Nicholson).

Hamilton: Falls of the Ohio; Utica, Indiana.

dictya hamiltonensis Ulrich.

90. Cystodictya hamiltonensis. Ulrich, Geol. Surv. Illinois, VIII, p. 493, pl. xlii, 4, pl. xliii, 1.

92. Cystodictya Hamiltonensis. Whiteaves, Contr. Canadian Pal. I, p. 279, pl. xxxvi, 2–2*b*.

Hamilton: Buffalo, Iowa; Rock Island, Illinois; Milwaukee, Wisconsin; Eighteen-Mile Creek, New York; several localities in Manitoba (Whiteaves).

Cystodictya incisurata (Hall).

1883. Stictopora incisurata. Hall, Trans. Albany Institute, X, p. 189
1881, p. 189).
1884. Stictopora incisurata. Hall, Rep. State Geologist New York for
1883, p. 38.
1887. Stictopora incisurata. Hall and Simpson, Pal. New York, VI,
lx, 1-18.
1890. Cystodictya incisurata. Ulrich, Geol. Surv. Illinois, VIII, p. 492
1897. Cystodictya incisurata. Simpson, Fourteenth Ann. Rep. State
New York for the year 1894, pl. x, 11.
1898. Cystodictya incisurata. Whiteaves, Contr. Canadian Pal., I, p.
1899. Stictopora incisurata. Grabau, Bull. Buffalo Soc. Nat. Sci., V
fig. 67.
1883. Stictopora indenta. Hall, Trans. Albany Institute, X, p. 189
1881, p. 189).
1884. Stictopora indenta. Hall, Rep. State Geologist New York for
1883, p. 40.
1883. Stictopora obliqua. Hall, Trans. Albany Institute, X, p. 189
1881, p. 189).
1884. Stictopora obliqua. Hall, Rep. State Geologist New York for
1883, p. 39.
1883. Stictopora multipora. Hall, Trans. Albany Institute, X, p. 190
1881, p. 190).
1884. Stictopora multipora. Hall, Rep. State Geologist New York for
1883, p. 43.
Hamilton: Lodi Landing, Seneca County, Eighteenmile Creek,
other localities in central and western New York; Thedford, O

Cystodictya ? incrassata Whiteaves. See Stictopora ?? incrassat

Cystodictya ? invertis (Hall).

1883. Stictopora invertis. Hall, Trans. Albany Institute, X, p. 157
1881, p. 15).
1883. Stictopora invertis. Hall, Rep. State Geologist New York fo
1882, pl. (28) xxv, 24-26.
1887. Stictopora invertis. Hall and Simpson, Pal. New York, VI,
xxviii, 24-26.
1890. Cystodictya invertis. Ulrich, Geol. Surv. Illinois, VIII, p. 492.
Upper Helderberg: New York.

Cystodictya limata (Hall and Simpson).

1887. Stictopora limata. Hall and Simpson, Pal. New York, VI, p
lxi, 14-16.
1890. Cystodictya limata. Ulrich, Geol. Surv. Illinois, VIII, p. 492.
1891. Stictopora limata. Hall, Tenth Ann. Rep. State Geologist New
the year 1890, p. 44; Forty-fourth Ann. Rep. New York St
p. 74.
Hamilton: Darien Center, New York.
Obs. See also Cystodictya subrigida (Hall).

Cystodictya linearis (Hall).

1883. Stictopora linearis. Hall, Trans. Albany Institute, X, p. 157
1881, p. 15).
1883. Stictopora linearis. Hall, Rep. State Geologist New York for
1882, pl. (28) xxv, 4, 5.
1887. Stictopora linearis. Hall and Simpson, Pal. New York, VI, p. 96,
1, pl. xxviii, 4, 5.

odictya linearis (Hall)—Continued.

890. Cystodictya linearis. Ulrich, Geol. Surv. Illinois, VIII, p. 492.

886. Stictopora rectilatera. Hall, Fifth Ann. Rep. State Geologist New York for the year 1885, pl. xxvii, 1.

Upper Helderberg: Onondaga Valley and Le Roy, New York.

odictya lineata Ulrich.

884. Cystodictya lineata. Ulrich, Jour. Cincinnati Soc. Nat. Hist., VII, p. 37, pl. ii, 4-4*c*.

Keokuk: Kings Mountain, Kentucky.

odictya lineata-major Ulrich.

890. Cystodictya lineata var. major. Ulrich, Geol. Surv. Illinois, VIII, p. 495, pl. lxxvi, 3.

St. Louis: Alton, Illinois.

odictya lineata-sancti-ludovici Ulrich.

890. Cystodictya lineata var. sancti-ludovici, Ulrich, Geol. Surv. Illinois, VIII, p. 492.

St. Louis: St. Louis, Missouri; Eddyville and Elizabethtown, Kentucky.

odictya meeki (Nicholson).

874. Ptilodictya Meeki. Nicholson, Geol. Mag., new ser., I, p. 123, pl. vi, 14.

874. Ptilodictya Meeki. Nicholson, Pal. Province Ontario, p. 97, fig. 34.

898. Cystodictya Meeki. Whiteaves, Contr. Canadian Pal., I, p. 377.

Upper Helderberg: Port Colborne, Ontario.

Hamilton: Arkona, Ontario.

Obs. This may be a synonym for Cystodictya sulcata (Winchell).

odictya nitida Ulrich.

890. Cystodictya nitida. Ulrich, Geol. Surv. Illinois, VIII, p. 493, pl. lxxvi, 4-4c.

894. Cystodictya nitida. Keyes, Missouri Geol. Surv., V, p. 17.

Keokuk: Bentonsport, Iowa.

odictya ocellata Ulrich.

882. Cystodictya occellata. Ulrich, Jour. Cincinnati Soc. Nat. Hist., V, p. 170, pl. viii, 3, 3*a*.

884. Cystodictya ocellata. Ulrich, Jour. Cincinnati Soc. Nat. Hist., VII, pl. ii, 3, 3*a*.

889. Cystodictya ocellata. Miller, North American Geol. Pal., figs. 469, 470 (p. 299).

890. Cystodictya occellata. Ulrich, Geol. Surv. Illinois, VIII, fig. 8*d* (p. 320).

Keokuk: Near Somerset, Kentucky.

odictya ovata (Hall and Simpson).

887. Stictopora ovata. Hall and Simpson, Pal. New York, VI, p. 248, pl. lxiii, 24.

890. Cystodictya ovata. Ulrich, Geol. Surv. Illinois, VIII, p. 492.

891. Stictopora ovata. Hall, Tenth Ann. Rep. State Geologist New York for the year 1890, p. 43; Forty-fourth Ann. Rep. New York State Mus., p. 73.

Hamilton: Canandaigua Lake, New York.

odictya ovatipora (Hall).

883. Stictopora ovatipora. Hall, Trans. Albany Institute, X, p. 156 (abstract, 1881, p. 14).

883. Stictopora ovatipora. Hall, Rep. State Geologist New York for the year 1882, pl. (28) xxv, 23, 23*a*.

Cystodictya ovatipora (Hall)—Continued.

1886. Stictopora ovatipora. Hall, Fifth Ann. Rep. State Geologist N for the year 1885, pl. xxvii, 12–19.

1887. Stictopora ovatipora. Hall and Simpson, Pal. New York, VI, xxvii, 12–19 (not pl. xxviii, 23, 23*a*).

1890. Cystodictya ovatipora. Ulrich, Geol. Surv. Illinois, VIII, p. 492

1897. Cystodictya ovatipora. Simpson, Fourteenth Ann. Rep. State New York for the year 1894, pl. x, 18, 19.

Not Stictopora ovatipora. Miller, North American Geol. Pal., (p. 324), = Stictotrypa similis (Hall).

Hamilton: Falls of the Ohio.

Cystodictya perarcta (Hall).

1883. Stictopora perarcta. Hall, Trans. Albany Institute, X, p. 157 (1881, p. 15).

1886. Stictopora perarcta. Hall, Fifth Ann. Rep. State Geologist N for the year 1885, pl. xxix, 36, 37.

1887. Stictopora perarcta. Hall and Simpson, Pal. New York, VI, p xxix, 36, 37.

1890. Cystodictya perarcta. Ulrich, Geol. Surv. Illinois, VIII, p. 492.

Upper Helderberg: Onondaga Valley, New York.

Cystodictya pustulosa Ulrich.

1890. Cystodictya pustulosa. Ulrich, Geol. Surv. Illinois, VIII, p. 495, 2, 2*a*.

1894. Cystodictya pustulosa. Keyes, Missouri Geol. Surv., V, p. 17.

Keokuk: Kings Mountain, Kentucky; Keokuk, Iowa; War Nauvoo, Illinois.

Cystodictya recta (Hall and Simpson).

1887. Stictopora recta. Hall and Simpson, Pal. New York, VI, p. 253.

1891. Stictopora recta. Hall, Tenth Ann. Rep. State Geologist New Yor year 1890, p. 47; Forty-fourth Ann. Rep. New York State Mus.,

1899. Stictopora recta. Grabau, Bull. Buffalo Soc. Nat. Sci., VI, p. 173.

Hamilton: West Hamburg, New York.

Cystodictya rectilinea (Hall and Simpson).

1887. Stictopora rectalinea. Hall and Simpson, Pal. New York, VI, p lxiii, 23.

1890. Cystodictya rectalinea. Ulrich, Geol. Surv. Illinois, VIII, p. 492.

1891. Stictopora rectalinea. Hall, Tenth Ann. Rep. State Geologist N for the year 1890, p. 40; Forty-fourth Ann. Rep. New York Sta p. 70.

1898. Cystodictya rectilinea. Whiteaves, Contr. Canadian Pal., I, p. 377

Hamilton: West Williams, Ontario.

Cystodictya rigida (Hall).

1883. Stictopora rigida. Hall, Trans. Albany Institute, X, p. 156 (1881, p. 14).

1883. Stictopora rigida. Hall, Rep. State Geologist New York for the y pl. (28) xxv, 15, 16.

1887. Stictopora rigida. Hall and Simpson, Pal. New York, VI, p. 91, p 15, 16.

1890. Cystodictya rigida. Ulrich, Geol. Surv. Illinois, VIII, p. 492.

Upper Helderberg: Near Le Roy, New York.

dictya semistriata (Hall).

83. Stictopora semistriata. Hall, Trans. Albany Institute, X, p 156 (abstract, 1881, p. 14).

83. Stictopora semistriata. Hall, Rep. State Geologist New York for the year 1882, pl. (28) xxv, 17–20.

87. Stictopora semistriata. Hall and Simpson, Pal. New York, VI, p. 95, pl xxviii, 17–20.

90. Cystodictya semistriata. Ulrich, Geol. Surv. Illinois, VIII, p. 492.
Upper Helderberg: Near Le Roy, New York.

dictya simulans Ulrich.

88. Cystodictya simulans. Ulrich, Bull. Denison Univ., IV, p. 81, pl. xiii, 10.
Keokuk: Warsaw, Illinois; Keokuk, Iowa.
Waverly: Moots Run, Ohio.

dictya sinuosa (Hall).

83. Stictopora sinuosa. Hall, Trans. Albany Institute, X, p. 190 (abstract, 1881, p. 190).

84. Stictopora sinuosa. Hall, Rep. State Geologist New York for the year 1883, p. 42.

87. Stictopora sinuosa. Hall and Simpson, Pal. New York, VI, p. 247, pl. lxi, 17.

90. Cystodictya sinuosa. Ulrich, Geol. Surv. Illinois, VIII, p. 492.

91. Stictopora sinuosa. Hall, Tenth Ann. Rep. State Geologist New York for the year 1890, p. 42; Forty-fourth Ann. Rep. New York State Mus., p. 72.

97. Stictocella sinuosa. Simpson, Fourteenth Ann. Rep. State Geologist New York for the year 1894, p. 532.

99. Stictopora sinuosa. Grabau, Bull. Buffalo Soc. Nat. Sci., VI, p. 173, fig. 68.
Hamilton: South of Auburn and Eighteen-Mile Creek, New York.

dictya subrigida (Hall).

83. Stictopora subrigida. Hall, Trans. Albany Institute, X, p. 190 (abstract, 1881, p. 190).

84. Stictopora subrigida. Hall, Rep. State Geologist New York for the year 1883, p. 43.

87. Stictopora subrigida. Hall and Simpson, Pal. New York, VI, p. 251, pl. lx, 21.

90. Cystodictya subrigida. Ulrich, Geol. Surv. Illinois, VIII, p. 492.

91. Stictopora subrigida. Hall, Tenth Ann. Rep. State Geologist New York for the year 1890, p. 45; Forty-fourth Ann. Rep. New York State Mus., p. 75.

84. Stictopora crenulata. Hall, Rep. State Geologist New York for the year 1883, p. 44.

87. Stictopora crenulata. Hall and Simpson, Pal. New York, VI, p. 252, pl. lx, 22.

90. Cystodictya crenulata. Ulrich, Geol. Surv. Illinois, VIII, p. 492.

91. Stictopora crenulata. Hall, Tenth Ann. Rep. State Geologist New York for the year 1890, p. 45; Forty-fourth Ann. Rep. New York State Mus., p. 75.
Hamilton: Near Middleburg and near Alden Station, New York.
Obs. Cystodictya limata (Hall and Simpson) may be a synonym of this species.

Cystodictya sulcata (Winchell).
1866. Stictopora sulcata. Winchell, Rep. Lower Penin. Michigan, p. 92.
1890. Cystodictya sulcata. Ulrich, Geol. Surv. Illinois, VIII, p. 492.
Hamilton: Petoskey, Michigan.
Obs. Compare Cystodictya meeki (Nicholson) with this species.

Cystodictya trilineata (Hall and Simpson).
1887. Stictopora trilineata. Hall and Simpson, Pal. New York, VI, p
lxi, 26, 27.
1890. Cystodictya trilineata. Ulrich, Geol. Surv. Illinois, VIII, p. 492.
Hamilton: Moscow and near Canandaigua Lake, New York.

Cystodictya tumulosa (Hall and Simpson).
1887. Stictopora tumulosa. Hall and Simpson, Pal. New York, VI, p.
lxi, 18–22.
1890. Cystodictya tumulosa. Ulrich, Geol. Surv. Illinois, VIII, p. 492
1891. Stictopora tumulosa. Hall, Tenth Ann. Rep. State Geologist Ne
for the year 1890, p. 41; Forty-fourth Ann. Rep. New York Sta
p. 71.
Hamilton: Moscow, and south of Le Roy, New York.

Cystodictya vermicula (Hall).
1886. Stictopora vermicula. Hall, Fifth Ann. Rep. State Geologist Ne
for the year 1885, pl. xxvii, 2–4.
1887. Stictopora vermicula. Hall and Simpson, Pal. New York, VI,
xxvii, 2–4.
1890. Cystodictya vermicula. Ulrich, Geol. Surv. Illinois, VIII, p. 49
Hamilton: Falls of the Ohio.

Cystodictya zigzag Ulrich.
1888. Cystodictya zigzag. Ulrich, Bull. Denison Univ., IV., p. 81, pl. xiii
Keokuk: Keokuk, Iowa.
Waverly (Cuyahoga shale): Richfield, Ohio.

CYSTOPORA Hall. Genotype: Cystopora geniculata Hall.
1883. Cystopora. Hall, Trans. Albany Institute, X, p. 161 (abstra
p. 19).
1887. Cystopora. Hall and Simpson, Pal. New York, VI, p. xxv.
1889. Cystopora. Miller, North American Geol. Pal., p. 300.
1897. Cystopora. Simpson, Fourteenth Ann. Rep. State Geologist Ne
for the year 1894, p. 598.

Cystopora geniculata Hall.
1883. Cystopora geniculata. Hall, Trans. Albany Institute, X, p. 161 (
1881, p. 20).
1887. Cystopora geniculata. Hall and Simpson, Pal. New York, VI, p.
lxvi, 7–10.
1897. Cystopora geniculata. Simpson, Fourteenth Ann. Rep. State G
New York for the year 1894, pl. xxv, 3–5.
Hamilton: Falls of the Ohio.

DEKAYELLA Ulrich. Genotype: Dekayella obscura Ulrich.
1882. Dekayella. Ulrich, Jour. Cincinnati Soc. Nat. Hist., V, p. 155; i
1883, p. 90.
1889. Dekayella. Miller, North American Geol. Pal., p. 184.
1890. Dekayella. Ulrich, Geol. Surv. Illinois, VIII, p. 372.
1893. Dekayella. Ulrich, Geol. Minnesota, III, p. 269.
1896. Dekayella. Ulrich, Zittel's Textb. Pal. (Engl. ed.), p. 273.

AYELLA Ulrich—Continued.

897. Dekayella. Simpson, Fourteenth Ann. Rep. State Geologist New York for the year 1894, p. 589.

yella obscura Ulrich.

883. Dekayella obscura. Ulrich, Jour. Cincinnati Soc. Nat. Hist., VI, p. 89, pl. i, 4–4*b*.

896. Dekayella obscura. Ulrich, Zittel's Textb. Pal. (Engl. ed.), fig. 454 (p. 274).

897. Dekayella obscura. Simpson, Fourteenth Ann. Rep. State Geologist New York for the year 1894, figs. 180–182 (p. 589).

Cincinnati (Utica): Cincinnati, Ohio, and vicinity.

yella prænuntia Ulrich.

893. Dekayella prænuntia. Ulrich, Geol. Minnesota, III, p. 270, pl. xxiii, 32–47.

897. Dekayella prænuntia. Simpson, Fourteenth Ann. Rep. State Geologist New York for the year 1894, figs. 177–179 (p. 589).

Trenton (Black River): Minneapolis, St. Paul, and Goodhue and Fillmore counties, Minnesota.

yella prænuntia-echinata Ulrich.

893. Dekayella prænuntia var. echinata. Ulrich, Geol. Minnesota, III, p. 271, pl. xxiii, 32–38.

Trenton (Black River): Fountain, Minneapolis and St. Paul, Minnesota.

yella prænuntia-multipora Ulrich.

893. Dekayella prænuntia var. multipora. Ulrich, Geol. Minnesota, III, p. 272, pl. xxiii, 44–47.

Trenton (Black River): Minneapolis, St. Paul, and Goodhue and Fillmore counties, Minnesota.

yella prænuntia-nævigera Ulrich.

893. Dekayella prænuntia var. nævigera. Ulrich, Geol. Minnesota, III, p. 271.

Trenton (Black River): Fillmore County, Minnesota.

yella prænuntia-simplex Ulrich.

893. Dekayella prænuntia var. simplex. Ulrich, Geol. Minnesota, III, p. 271, pl. xxiii, 39–42.

Trenton (Stones River and Black River): Minneapolis and St. Paul, Minnesota.

yella trentonensis (Ulrich).

883. Dekayia trentonensis. Ulrich, Jour. Cincinnati Soc. Nat. Hist., V, p. 151, pl. vi, 6, 6*a*.

893. Dekayia trentonensis. Ulrich, Geol. Minnesota, III, p. 274.

Trenton: Burgin and Frankfort, Kentucky; St. Paul and Cannon Falls, Minnesota.

yella ulrichi (Nicholson).

874. Chætetes Fletcheri (not of Milne-Edwards and Haime). Nicholson, Quar. Jour. Geol. Soc. London, XXX, p. 504, pl. xxix, 6, 6*a*.

875. Chætetes Fletcheri (not of Milne-Edwards and Haime). Nicholson, Pal. Ohio, II, p. 197, pl. xxi, 7, 7a.

876. Chætetes Fletcheri (not of Milne-Edwards and Haime). Nicholson, Ann. Mag. Nat. Hist., ser. 4, XVIII, p. 90, pl. v, 14.

881. Chætetes Fletscheri (not of Milne-Edwards and Haime). Quenstedt, Roehren- und Sternkorallen. p. 83, pl. cxlvi, 27.

Dekayella ulrichi (Nicholson)—Continued.

1881. Monticulipora (Heterotrypa) Ulrichii. Nicholson, Genus Montic p. 131, fig. 22.

1883. Monticulipora ulrichii. (Van Cleve) Hall, Twelfth Ann. Rep. Geol. Nat. Hist., p. 249, pl. xi, 10.

1883. Dekayella ulrichi. Ulrich, Jour. Cincinnati Soc. Nat. Hist., VI, pp.

1888. Monticulipora ulrichii. James and James, Jour. Cincinnati Soc. Na X, p. 179.

1894. Monticulipora ulrichii. J. F. James, Jour. Cincinnati Soc. Nat. Hist p. 201.

Cincinnati (Utica): Cincinnati, Ohio, and vicinity.

Dekayella ulrichi-robusta Foord.

1884. Dekayella robusta. Foord, Ann. Mag. Nat. Hist., ser. 5, XIII, p. xii, 2–2*d*.

1884. Monticulipora ohioensis. James, Jour. Cincinnati Soc. Nat. Hist., 137, pl. vii, 1, 1*a*.

1888. Monticulipora ohioensis. James and James, Jour. Cincinnati So Hist., X, p. 183.

1894. Monticulipora ohioensis. J. F. James, Jour. Cincinnati Soc. Na XVI, p. 207.

Cincinnati (Utica): Cincinnati, Ohio, and vicinity.

DEKAYIA Milne-Edwards and Haime. Genotype: Dekayia Milne-Edwards and Haime.

1851. Dekayia. Milne-Edwards and Haime, Pol. Foss. Terr. Pal., p. 27

1860. Dekayia. Milne-Edwards, Hist. Nat. des Corall., III, p. 283.

1879. Dekayia. Nicholson, Pal. Tabulate Corals, p. 291.

1881. Dekayia. Nicholson, Genus Monticulipora, p. 98.

1882. Dekayia. Ulrich, Jour. Cincinnati Soc. Nat. Hist., V, p. 155; ib 1883, p. 148.

1886. Dekayia. Waagen and Wentzel, Pal. Indica, Ser. XIII, p. 874.

1888. Dekayia. James and James, Jour. Cincinnati Soc. Nat. Hist., X

1889. Dekayia. Miller, North American Geol. Pal., p. 184.

1890. Dekayia. Ulrich, Geol. Surv. Illinois, VIII, pp. 371, 415.

1893. Dekayia. Ulrich, Geol. Minnesota, III, p. 274.

1896. Dekayia. Ulrich, Zittel's Textb. Pal. (Engl. ed.), p. 273.

1896. Dekayia. J. F. James, Jour. Cincinnati Soc. Nat. Hist., XVIII, p

1897. Dekayia. Simpson, Fourteenth Ann. Rep. State Geologist New Y the year 1894, p. 578.

Dekayia appressa Ulrich.

1883. Dekayia appressa. Ulrich, Jour. Cincinnati Soc. Nat. Hist., VII, pl. vi, 7–7*b*.

Cincinnati (Lorraine): Cincinnati, Ohio, and vicinity.

Dekayia aspera Milne-Edwards and Haime.

1851. Dekayia aspera. Milne-Edwards and Haime, Pol. Foss. Terr. Pal. pl. xvi, 2, 2*a*.

1860. Dekayia aspera. Milne-Edwards, Hist. Nat. des Corall., III, p. 2

1883. Dekayia aspera. Ulrich, Jour. Cincinnati Soc. Nat. Hist., VI, pl. vi, 5.

1888. Monticulipora (Dekayia) aspera. James and James, Jour. Ci Soc. Nat. Hist., XI, p. 28.

1896. Monticulipora (Dekayia) aspera. J. F. James, Jour. Cincinnati S Hist., XVIII, p. 116.

yia aspera Milne-Edwards and Haime—Continued.

396. Dekayia aspera. Ulrich, Zittel's Textb. Pal. (Eng. ed.), fig. 455 (p. 274).
374. Chætetes attritus. Nicholson, Quar. Jour. Geol. Soc. London, XXX, p. 503, pl. xxix, 4, 4*a*.
375. Chætetes attritus. Nicholson, Pal. Ohio, II, p. 194, pl. xxi, 4.
376. Dekayia attrita. Nicholson, Ann. Mag. Nat. Hist., ser. 4, XVIII, p. 93, pl. v, 12, 12*a*.
379. Dekayia attrita. Nicholson, Pal. Tabulate Corals, p. 298, pl. xv, 1-1*e*.
Cincinnati (Lorraine): Cincinnati, Ohio, and vicinity.

yia attrita Nicholson. See Dekayia aspera Milne-Edwards and ime.

yia? devonica Ulrich.

390. Dekayia devonica. Ulrich, Geol. Surv. Illinois, VIII, p. 416, pl. xlv, 5-5*d*.
397. Dekayia devonica. Simpson, Fourteenth Ann. Rep. State Geologist New York, for the year 1894, figs. 141-144 (p. 578).
Hamilton: Falls of the Ohio; Eighteen-Mile Creek, New York.

yia maculata James.

381. Dekayia maculata. James, Paleontologist, No. 5, p. 37.
396. Monticulipora (Dekayia) maculata. J. F. James, Jour. Cincinnati Soc. Nat. Hist., XVIII, p. 116, fig. 11.
Cincinnati (Utica): Loveland and Cincinnati, Ohio, and vicinity.

yia multispinosa Ulrich.

383. Dekayia multispinosa. Ulrich, Jour. Cincinnati Soc. Nat. Hist., VI, p. 154, pl. vi, 8, 8*a*.
Cincinnati (Lorraine): Cincinnati, Ohio, and vicinity.

yia paupera Ulrich. See Heterotrypa paupera (Ulrich).

yia pelliculata Ulrich.

383. Dekayia pelliculata. Ulrich, Jour. Cincinnati Soc. Nat. Hist., VI, p. 150, pl. vi, 9, 9*a*.
396. Monticulipora (Dekayia) pelliculata. J. F. James, Jour. Cincinnati Soc. Nat. Hist., XVIII, p. 117.
Cincinnati (Lorraine): Cincinnati, Ohio, and vicinity.

yia trentonensis Ulrich. See Dekayella trentonensis (Ulrich).

lricopora De Koninck. See Ptilopora McCoy.

IESOPORA Hall. Genotype: Diamesopora dichotoma Hall.

352. Diamesopora. Hall, Pal. New York, II, p. 158. (Not defined.)
387. Diamesopora. Hall and Simpson, Pal. New York, VI, pp. xv, 19.
389. Diamesopora. Miller, North American Geol. Pal., p. 300.
397. Diamesopora. Simpson, Fourteenth Ann. Rep. State Geologist New York, for the year 1894, p. 566.
Not Diamesopora (= Cœloclema). Ulrich, Geol. Surv. Illinois, VIII, 1890, pp. 380, 467; Geol. Minnesota, III, 1893, p. 330; Zittel's Textb. Pal. (Engl. ed.), 1896, p. 268.

esopora camerata Hall and Simpson. See Chilotrypa camerata all).

esopora communis Ulrich. See Cœloclema concentricum (James).

esopora constricta Hall and Simpson. See Chilotrypa constricta all).

Diamesopora dichotoma Hall.

1852. Diamesopora dichotoma. Hall, Pal. New York, II, p. 158, pl. xl B
Niagara: Lockport, New York.

Diamesopora dispersa Hall. See Chilotrypa dispersa (Hall).

Diamesopora infrequens (Hall).

1876. Trematopora infrequens. Hall, Twenty-eighth Ann. Rep. New Yor Mus. (documentary edition), pl. x, 13, 14 (in error for 3, 4) (Museum edition, 1879), p. 111, pl. x, 3 (in part), 4.
1882. Trematopora infrequens. Hall, Eleventh Ann. Rep. Indiana Geo Hist., p. 232, pl. ix, 3 (in part), 4.
1883. Cœloclema infrequens. Ulrich, Jour. Cincinnati Soc. Nat. Hist., VI,
1890. Diamesopora infrequens. Ulrich, Geol. Surv. Illinois, VIII, p. 46
Niagara: Waldron, Indiana.

Diamesopora osculum (Hall).

1876. Trematopora osculum. Hall, Twenty-eighth Ann. Rep. New Yor Mus. (documentary edition), pl. x, 3–12 (3 and 4 in error); (Museum edition, 1879), p. 110, pl. x, 5–8, 11–14.
1882. Trematopora osculum. Hall, Eleventh Ann. Rep. Indiana Geo Hist., p. 231, pl. ix, 5–8, 11–14.
1883. Cœloclema osculum. Ulrich, Jour. Cincinnati Soc. Nat. Hist., VI,
1890. Diamesopora osculum. Ulrich, Geol. Surv. Illinois, VIII, p. 467.
Niagara: Waldron, Indiana.

Diamesopora oweni Ulrich. See Cœloclema oweni (James).

Diamesopora subimbricata (Hall).

1879. Trematopora subimbricata. Hall, Twenty-eighth Ann. Rep. New State Mus. (Museum edition), pl. x, 9, 10.
1883. Trematopora subimbricata. Hall, Trans. Albany Institute, X, (abstract, 1879, p. 4).
1882. Trematopora subimbricata. Hall, Eleventh Ann. Rep. Indiana Nat. Hist., p. 234, pl. ix, 9, 10.
1882. Cœloclema imbricata. Ulrich, Jour. Cincinnati Soc. Nat. Hist., VI,
1890. Diamesopora subimbricata. Ulrich, Geol. Surv. Illinois, VIII, p.
Niagara: Waldron, Indiana.

Diamesopora trentonensis Ulrich. See Cœloclema trentonensis (U

Diamesopora ? tubulosa (Hall).

1852. Trematopora tubulosa. Hall, Pal. New York, II, p. 151, pl. xl A,
1866. Diamesopora tubulosa. Rominger, Proc. Acad. Nat. Sci. Philadelphia
1890. Diamesopora tubulosa. Ulrich, Geol. Surv. Illinois, VIII, p. 467.
Clinton: Wayne County, New York.

Diamesopora varia Ulrich. See Chilotrypa varia (Hall).

Diamesopora vaupeli Ulrich. See Cœloclema alternatum (Jame

DIANULITES Eichwald.

1829. Dianulites. Eichwald, Zool. Spec., I, p. 180.
1860. Dianulites. Eichwald, Lethæa Rossica, I, p. 487.
1877. Dianulites. Dybowski, Die Chætetiden der Ostbaltischen Silur p. 14.
1881. Dianulites. Nicholson, Genus Monticulipora, pp. 20, 155.
1886. Dianulites. Waagen and Wentzel, Pal. Indica, Ser. XIII, p. 874.
1897. Dianulites. Simpson, Fourteenth Ann. Rep. State Geologist Nev for the year 1894, p. 587.

IULITES Eichwald—Continued.

Obs. This genus as defined by Eichwald is wholly unintelligible and was, until 1877 when Dybowski resurrected and redefined it, not recognized by paleontologists. Dybowski has not helped the matter by his effort, for his arrangement of the species is quite arbitrary, no two forms perhaps being strictly congeneric.

toporella Vine. See Berenicea Lamouroux.

TOPORINA Ulrich. Genotype: Diastoporina flabellata Ulrich.

890. Diastoporina. Ulrich, Jour. Cincinnati Soc. Nat. Hist., XII, p. 177.

892. Diastoporina. Miller, North American Geol. Pal., First Appendix, p. 684.

893. Diastoporina. Ulrich, Geol. Minnesota, III, p. 121.

897. Diastoporina. Simpson, Fourteenth Ann. Rep. State Geologist New York for the year 1894, p. 595.

oporina flabellata Ulrich.

890. Diastoporina flabellata. Ulrich, Jour. Cincinnati Soc. Nat. Hist., XII, p. 178, fig. 5.

893. Diastoporina flabellata. Ulrich, Geol. Minnesota, III, p. 122, pl. ii, 2, 3.

897. Diastoporina flabellata. Simpson, Fourteenth Ann. Rep. State Geologist New York for the year 1894, figs. 199, 200 (p. 595).

Trenton: Cannon Falls and St. Paul, Minnesota.

IOTRYPA Ulrich. Genotype: Dichotrypa foliata Ulrich.

890. Dichotrypa. Ulrich, Geol. Surv. Illinois, VIII, pp. 386, 498.

889. Dichotrypa. (Ulrich, in press) Miller, North American Geol. Pal., p.300.

otrypa elegans Ulrich.

890. Dichotrypa elegans. Ulrich, Geol. Surv. Illinois, VIII, p. 500, pl. lxxvi, 8–8*d*.

St. Louis: Elizabethtown, Kentucky; Jersey and Monroe counties, Illinois.

Obs. See Dichotrypa grandis Ulrich for a probable synonym.

otrypa expatiata Ulrich.

890. Dichotrypa expatiata. Ulrich, Geol. Surv. Illinois, VIII, p. 501.

St. Louis: Alton, Illinois.

otrypa flabellum (Rominger).

866. Fistulipora flabellum. Rominger, Proc. Acad. Nat. Sci. Philadelphia, p. 122.

890. Dichotrypa flabellum. Ulrich, Geol. Surv. Illinois, VIII, p. 501, pl. lxxvii, 1–1*b*.

Warsaw: Spergen Hill, Indiana.

St. Louis: Elizabethtown and Eddyville, Kentucky; Clarksville, Tennessee.

otrypa foliata Ulrich.

890. Dichotrypa foliata. Ulrich, Geol. Surv. Illinois, VIII, p. 499, pl. xlii, 2–2*g*.

Hamilton: Buffalo, Iowa.

otrypa grandis Ulrich.

890. Dichotrypa grandis. Ulrich, Geol. Surv. Illinois, VIII, p. 498, pl. xlii, 1–1*e*.

Niagara (?): Will County, near Wilmington, Illinois (?).

Obs. This form is probably from the St. Louis group of Illinois and may be the same as Dichotrypa elegans Ulrich.

otrypa intermedia Ulrich.

890. Dichotrypa intermedia. Ulrich, Geol. Surv. Illinois, VIII, p. 500, pl. lxxvi, 9–9*c*.

Dichotrypa intermedia Ulrich—Continued.

1894. Dichotrypa intermedia. Keyes, Missouri Geol. Surv., V, p. 18.
St. Louis: Alton and Columbia, Illinois; St. Louis, Missouri.

Dichotrypa lyroides Ulrich.

1890. Dichotrypa lyroides. Ulrich, Geol. Surv. Illinois, VIII, p. 502, pl
2–2*b*.
St. Louis: Southern Kentucky.

DICRANOPORA Ulrich. Genotype: Ptilodictya internodia Mil
Dyer.

1882. Dicranopora. Ulrich, Jour. Cincinnati Soc. Nat. Hist., V, pp. 15
1889. Dicranopora. Miller, North American Geol. Pal., p. 300.
1890. Dicranopora. Ulrich, Geol. Surv. Illinois, VIII, p. 389.
1897. Dicranopora. Simpson, Fourteenth Ann. Rep. State Geologist N
for the year 1894, p. 545.

Dicranopora emacerata (Nicholson).

1875. Ptilodictya emacerata. Nicholson, Ann. Mag. Nat. Hist., ser. 4,
179, pl. xiv, 3–3*b*.
1875. Ptilodictya emacerata. Nicholson, Pal. Ohio, II, p. 261, pl. xxv,
1889. Dicranopora emacerata. Ulrich, Contr. Micro-Pal. Cambro-Sil.,
p. 40.
1895. Dicranopora emacerata. Whiteaves, Pal. Foss., III, p. 118.
Cincinnati (Lorraine and Richmond): Cincinnati, Ohio, and
Stony Mountain, Manitoba.

Dicranopora fragilis (Billings).

1866. Ptilodictya fragilis. Billings, Catal. Sil. Foss. Anticosti, p. 9.
1882. Stictopora fragilis. Whitfield, Geol. Surv. Wisconsin, IV, p. 253, p
1889. Dicranopora fragilis. Ulrich, Contr. Micro-Pal. Cambro-Sil., Part
1895. Dicranopora fragilis. Whiteaves, Pal. Foss., III, p. 118.
Anticosti: Anticosti Island.
Cincinnati (Richmond): Iron Ridge, Wisconsin; Stony Mountai
toba.

Dicranopora granulosa (Hall and Simpson).

1883. Escharopora (Ptilodictya) lirata (in part). Hall, Rep. State
New York for the year 1882, pl. xvii, 5, 6.
1887. Rhinidictya ? granulosa. Hall and Simpson, Pal. New York, V
pl. xvii, 5, 6, pl. xxiii A, 18, 19.
1897. Rhinidictya granulosa. Simpson, Fourteenth Ann. Rep. State
New York for the year 1894, pl. x, 3–5.
Lower Helderberg: Clarksville, New York.

Dicranopora internodia (Miller and Dyer).

1878. Ptilodictya internodia. Miller and Dyer, Contr. to Pal., No. 2, p.
7, 7*a*.
1882. Dicranopora internodia. Ulrich, Jour. Cincinnati Soc. Nat. His
166, pl. vii, 9, 9*a*.
1889. Dicranopora internodia. Miller, North American Geol. Pal., fi
300).
Cincinnati (Lorraine): Cincinnati, Ohio, and vicinity.
Obs. See also Helopora ?? meeki James.

Dicranopora lata Ulrich. See Rhinidictya lata (Ulrich).

anopora nitidula (Billings).
866. Ptilodictya nitidula. Billings, Catal. Sil. Foss. Anticosti, p. 9.
889. Dicranopora nitidula. Miller, North American Geol. Pal., p. 300.
Cincinnati (Richmond): Anticosti Island.

anopora parva Ami. Not recognizable.
892. Dicranopora parva. Ami, Canadian Record of Science, V, p. 99.
Trenton: Gagnon's Beach, Quebec.

anopora trentonensis Ulrich. See Rhinidictya trentonensis
lrich).

ymopora Ulrich. See Fistulipora McCoy.

LOCLEMA Ulrich. Genotype: Diploclema trentonense Ulrich.
890. Diploclema. Ulrich, Geol. Surv. Illinois, VIII, p. 368.
889. Diploclema. (Ulrich, in press), Miller, North American Geol. Pal., p. 300.
896. Diploclema. Ulrich, Zittel's Textb. Pal. (Engl. ed.), p. 262.

oclema sparsum (Hall).
852. Trematopora sparsa. Hall, Pal. New York, II, p. 155, pl. xl A, 12*a–d*.
890. Diploclema sparsum. Ulrich, Geol. Surv. Illinois, VIII, p. 369, pl. liii, 10.
Niagara: Lockport, New York.

oclema trentonense Ulrich.
890. Diploclema trentonense. Ulrich, Geol. Surv. Illinois, VIII, p. 369, pl. liii, 9–9*c*.
Trenton: Trenton Falls, New York.

opora Young and Young. See Diploporaria.

LOPORARIA.[1] Genotype: Glauconome (Diplopora) marginalis
oung and Young.
875. Diplopora. Young and Young, Proc. Nat. Hist. Soc. Glasgow, II, p. 326.
889. Diplopora. Miller, North American Geol. Pal., p. 300.
890. Diplopora. Ulrich, Geol. Surv. Illinois, VIII, pp. 398, 636.
895. Diplopora. Whidborne, Devon. Fauna England, (Pal. Soc. Publ.), II, pt. 4, p. 182.
896. Diplopora. Ulrich, Zittel's Textb. Pal. (Engl. ed.), p. 283.
897. Diplopora. Simpson, Fourteenth Ann. Rep. State Geologist New York for the year 1894, p. 525.
886. Nov. gen. Ulrich, Contr. American Pal., I, p. 5.

oporaria bifurcata (Ulrich).
890. Diplopora bifurcata. Ulrich, Geol. Surv. Illinois, VIII, p. 637, pl. lxii, 12, 12*a*.
894. Diplopora bifurcata. Keyes, Missouri Geol. Surv., V, p. 33.
897. Diplopora bifurcata. Simpson, Fourteenth Ann. Rep. State Geologist New York for the year 1894, figs. 76, 77 (p. 526).
Chester: Chester, Illinois.

oporaria biserialis (Ulrich).
1890. Diplopora biserialis. Ulrich, Geol. Surv. Illinois, VIII, p. 637, pl. lxii, 11–11*c*.
Lower Coal Measures: Seville, Illinois.

LOTRYPA Nicholson. Genotype: Favosites petropolitanus Pander.
1879. Diplotrypa. Nicholson, Pal. Tabulate Corals, p. 292.
1881. Diplotrypa. Nicholson, Genus Monticulipora, pp. 101, 155.

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oposed for Diplopora, preoccupied by Schafhäutl (see Neues Jahrbuch for Mineralogie, 1866, p. We have been unable to refer to Schafhäutl's work, Lethæa geognostica von Südbayern, ig, 1863.

DIPLOTRYPA Nicholson—Continued.

1882. Diplotrypa. Ulrich, Jour. Cincinnati Soc. Nat. Hist., V., p. 153.
1883. Diplotrypa. Foord, Contr. Micro-Pal. Cambro-Sil., p. 13.
1889. Diplotrypa. Miller, North American Geol. Pal., p. 187.
1890. Diplotrypa. Ulrich, Geol. Surv. Illinois, VIII, pp. 378, 457.
1893. Diplotrypa. Ulrich, Geol. Minnesota, III, p. 285.
1896. Diplotrypa. Ulrich, Zittel's Textb. Pal. (Engl. ed.), p. 275; a Ulrich) p. 104 (in part).
1877. Callopora (not Hall). Dybowski, Die Chætetiden d. Ostb. Silu p. 106.

Diplotrypa ? dubia Ulrich.

1890. Diplotrypa ? dubia. Ulrich, Geol. Surv. Illinois, VIII, p. 459, p 3–3*b*.
1894. Monticulipora dubia. J. F. James, Jour. Cincinnati Soc. Na XVI, p. 182.
Cincinnati (Richmond): Wilmington, Illinois.

Diplotrypa infida Ulrich. See Mesotrypa infida (Ulrich).

Diplotrypa limitaris Ulrich.

1893. Diplotrypa limitaris. Ulrich, Geol. Minnesota, III, p. 286, fig. 1
Trenton: Goodhue County, Minnesota.

Diplotrypa milleri Ulrich. See Mesotrypa milleri (Ulrich).

Diplotrypa neglecta Ulrich.

1893. Diplotrypa neglecta. Ulrich, Geol. Minnesota, III, p. 287, fig. 1
Trenton: Hader, Minnesota.

Diplotrypa patella Ulrich. See Mesotrypa patella (Ulrich).

Diplotrypa Quebecensis Ami. See Mesotrypa quebecensis (Am

Diplotrypa regularis Foord. See Mesotrypa regularis (Foord)

Diplotrypa westoni Ulrich.

1889. Diplotrypa Westoni. Ulrich, Contr. Micro-Pal. Cambro-Sil., Pa 30, pl. viii, 4–4*b*.
1896. Diplotrypa Westoni. Ulrich, Zittel's Textb. Pal. (Engl. ed.), fig 274).
1897. Diplotrypa Westoni. Whiteaves, Pal. Foss., III, part III, p. 163.
Trenton: Big Island, Lake Winnipeg, Manitoba.

DISCOTRYPA Ulrich. Genotype: Chætetes elegans Ulrich.

1882. Discotrypa. Ulrich, Jour. Cincinnati Soc. Nat. Hist., V, p. 155.
1889. Discotrypa. Miller, North American Geol. Pal., p. 300.
1890. Discotrypa. Ulrich, Geol. Surv. Illinois, VIII, p. 378.

Discotrypa ? devonica Ulrich.

1886. Discotrypa devonica. Ulrich, Contr. American Pal., I, p. 25, pl.
Hamilton: Falls of the Ohio.

Discotrypa elegans (Ulrich).

1879. Chætetes elegans. Ulrich, Jour. Cincinnati Soc. Nat. Hist., II, p. xii, 12, 12*a*.
1883. Discotrypa elegans. Ulrich, Jour. Cincinnati Soc. Nat. Hist., VI pl. vii, 1–1*b*.
1888. Monticulipora elegans. James and James, Jour. Cincinnati S Hist., X, p. 165.

trypa elegans (Ulrich)—Continued.
394. Monticulipora elegans. J. F. James, Jour. Cincinnati Soc. Nat. Hist., XVI, p. 180.
Cincinnati (Lorraine): Cincinnati, Ohio, and vicinity.

OPORA Dybowski. Genotype: Dittopora clavæformis Dybowski.
377. Dittopora. Dybowski, Die Chætetiden der Ostbaltischen Silur-form., p. 84.
381. Dittopora. Nicholson, Genus Monticulipora, p. 234.
Obs. This genus was established for a group of monticuliporoids occurring in the Silurian of Russia. The name has not become current in American literature.

MOTRYPA Ulrich. Genotype: Retepora diffusa Hall.
390. Drymotrypa. Ulrich, Geol. Surv, Illinois, VIII, p. 399.
392. Drymotrypa. Miller, North American Geol. Pal., First Appendix, p. 684.
397. Thamnocella. Simpson, Fourteenth Ann. Rep. State Geologist New York for the year 1894, p. 525.

otrypa cisseis (Hall).
379. Thamniscus ? Cisseis. Hall, Thirty-second Ann. Rep. New York State Museum, p. 176 (reprint 1880, p. 38).
383. Thamniscus ? Cisseis. Hall, Rep. State Geologist New York for the year 1882, pl. xxii, 23–30.
387. Thamniscus ? Cisseis. Hall and Simpson, Pal. New York, VI, p. 42, pl. xxii, 23–30.
390. Drymotrypa cisseis. Ulrich, Geol. Surv. Illinois, VIII, p. 399.
397. Thamnocella Cisseis. Simpson, Fourteenth Ann. Rep. State Geologist New York for the year 1894, pl. ix, 9–13.
Lower Helderberg: Clarksville, New York.

otrypa dichotoma (Ulrich).
390. Drymotrypa dichotoma. Ulrich, Geol. Surv. Illinois, VIII, p. 399, pl. liii, 6.
Trenton: Montreal, Canada.

otrypa diffusa (Hall).
352. Retepora diffusa. Hall, Pal. New York, II, p. 160, pl. xl C, 1*a–f*.
390. Drymotrypa diffusa. Ulrich, Geol. Surv. Illinois, VIII, pl. liii, 7–7*b*.
Niagara: Lockport, New York.

otrypa niagarensis (Hall).
376. Thamniscus ? Niagarensis. Hall, Twenty-eighth Ann. Rep. New York State Mus. (documentary edition), pl. xi, 22–25; ibid., (Museum edition, 1879), p. 126, pl. xi, 22–25.
382. Thamniscus niagarensis. Hall, Eleventh Ann. Rep. Indiana Geol. Nat. Hist., p. 254, pl. x, 22–25.
390. Drymotrypa niagarensis. Ulrich, Geol. Surv. Illinois, VIII, p. 399.
397. Thamniscus Niagarensis. Simpson, Fourteenth Ann. Rep. State Geologist New York for the year 1894, pl. ix, 15–17.
Niagara: Waldron, Indiana.

owskia Waagen and Pichl. See Fistulipora McCoy.

owskiella Waagen and Wentzel. See Fistulipora McCoy.

lopora D'Orbigny. Genotype: Gorgonia perantiqua Hall.
350. Enallopora. D'Orbigny, Prod. de Pal., I, p. 22.
389. Enallopora. Miller, North American Geol. Pal., p. 300.
Obs. For objections to the use of this name, see Geol. Surv. Illinois, VIII, p. 683.

Enallopora cinctosa Miller. See Mitoclema cinctosum Ulrich

Enallopora perantiqua D'Orbigny. See Gorgonia ? perantiqu

ERIDOPORA Ulrich. Genotype: Eridopora macrostoma Ulric

1882. Eridopora. Ulrich, Jour. Cincinnati Soc. Nat. Hist., V, pp. 137, 1
1889. Eridopora. Miller, North American Geol. Pal., p. 301.
1890. Eridopora. Ulrich, Geol. Surv. Illinois, VIII, p. 382.
1896. Eridopora. Ulrich, Zittel's Textb. Pal. (Engl. ed.), p. 269.
1897. Eridopora. Simpson, Fourteenth Ann. Rep. State Geologist New the year 1894, p. 561.
1886. Pileotrypa. Hall, Fifth Ann. Rep. State Geologist New York for 1885, expl. pl. xxx. (Not defined.)
1887. Pileotrypa. Hall and Simpson, Pal. New York, VI, p. xvi.
1889. Pileotrypa. Miller, North American Geol. Pal., p. 315.
1897. Pileotrypa. Simpson, Fourteenth Ann. Rep. State Geologist New the year 1894, p. 562.

Eridopora ? clivulata (Hall).

1883. Lichenalia clivulata. Hall, Trans. Albany Institute, X, p. 151 1881, p. 9).
1886. Lichenalia (Pileotrypa) clivulata. Hall, Fifth Ann. Rep. State New York for the year 1885, pl. xxxi, 30–33.
1887. Lichenalia (Pileotrypa) clivulata. Hall and Simpson, Pal. New p. 83, pl. xxxi, 30–33.
1897. Pileotrypa clivulata. Simpson, Fourteenth Ann. Rep. State Geolo York for the year 1894, pl. xxiii, 8.

Hamilton: Falls of the Ohio.

Eridopora denticulata (Hall).

1883. Lichenalia denticulata. Hall, Trans. Albany Institute, X, p. 149 1881, p. 8).
1883. Lichenalia denticulata. Hall, Rep. State Geologist New York fo 1882, pl. (26) xxiv, 21, 22, 27.
1886. Lichenalia (Pileotrypa) denticulata. Hall, Fifth Ann. Rep. State New York for the year 1885, pl. xxx, 12–20.
1887. Lichenalia (Pileotrypa) denticulata. Hall and Simpson, Pal. N VI, p. 84, pl. xxvi, 21, 22, 27, pl. xxx, 12–20.
1897. Pileotrypa denticulata. Simpson, Fourteenth Ann. Rep. State New York for the year 1894, pl. xxiii, 12.
1886. Eridopora minima. Ulrich, Contr. American Pal., I, p. 21, pl. i

Hamilton: Falls of the Ohio.

Eridopora macrostoma Ulrich.

1882. Eridopora macrostoma. Ulrich, Jour. Cincinnati Soc. Nat. Hist., pl. vi, 2, 2*a*.
1884. Eridopora macrostoma. Ulrich, Jour. Cincinnati Soc. Nat. H pl. iii, 8.
1897. Eridopora macrostoma. Simpson, Fourteenth Ann. Rep. State New York for the year 1894, fig. 128 (p. 561).

Chester: Sloans Valley, Smithland, and Grayson Springs, Kentu

Eridopora minima Ulrich. See Eridopora denticulata (Hall).

Eridopora punctifera Ulrich.

1882. Eridopora punctifera. Ulrich, Jour. Cincinnati Soc. Nat. Hist., pl. vi, 3.

Chester: Sloans Valley, Kentucky.

DOTRYPA Ulrich. Genotype: Eridotrypa mutabilis Ulrich.

890. Batostomella (in part). Ulrich, Geol. Surv. Illinois, VIII, pp. 375, 432.

893. Eridotrypa. Ulrich, Geol. Minnesota, III, p. 264.

otrypa appressa (Ulrich).

890. Monotrypella appressa. Ulrich, Geol. Surv. Illinois, VIII, p. 453, pl. xlvi, 1–1*e* (on plate called Monotrypella simplex in error).

Hamilton: Rock Island, Illinois; Davenport, Iowa.

otrypa briareus (Nicholson).

875. Chætetes briareus. Nicholson, Pal. Ohio, II, p. 202, pl. xxi, 13–13*b*.

881. Monticulipora (Monotrypa) briareus. Nicholson, Genus Monticulipora, p. 198, pl. ii, 5–5*c*.

882. Monotrypella briarea. Ulrich, Jour. Cincinnati Soc. Nat. Hist., V, pp. 248, 256.

888. Monticulipora briarea. James and James, Jour. Cincinnati Soc. Nat. Hist., X, p. 172.

894. Monticulipora briarea. J. F. James, Jour. Cincinnati Soc. Nat. Hist., XVI, p. 191.

Trenton: Covington, Kentucky; Maury County, Tennessee.

otrypa corticosa (Hall).

874. Trematopora corticosa. Hall, Twenty-sixth Ann. Rep. New York State Mus., p. 105.

879. Chætetes corticosus. Hall, Thirty-second Ann. Rep. New York State Mus., p. 149 (reprint, 1880, p. 11).

883. Trematopora (Chætetes) corticosa. Hall, Rep. State Geologist New York for the year 1882, pl. x, 1–10, pl. xiii, 4.

887. Trematopora ? (Trematella ?) corticosa. Hall and Simpson, Pal. New York, VI, p. 15, pl. x, 1–10, pl. xiii, 4, pl. xxiii, 20.

893. Eridotrypa corticosa. Ulrich, Geol. Minnesota, III, p. 265.

Lower Helderberg: Clarksville, New York.

otrypa echinata (Hall).

876. Trematopora echinata. Hall, Twenty-eighth Ann. Rep. New York State Mus. (documentary edition), pl. xi, 1–5; ibid. (Museum edition, 1879), p. 112, pl. xi, 1–5.

882. Trematopora echinata. Hall, Eleventh Ann. Rep. Indiana Geol. Nat. Hist., p. 233, pl. x, 1–5.

893. Eridotrypa echinata. Ulrich, Geol. Minnesota, III, p. 265.

Niagara: Waldron, Indiana.

otrypa exigua Ulrich.

893. Eridotrypa exigua. Ulrich, Geol. Minnesota, III, p. 266, pl. xxvi, 17–19.

Trenton: Cannon Falls, Minnesota.

otrypa mutabilis Ulrich.

893. Eridotrypa mutabilis. Ulrich, Geol. Minnesota, III, p. 265, pl. xxvi, 20–32.

Trenton: Goodhue, Ramsey, and Dakota counties, Minnesota; Decorah, Iowa; Neenah and Oshkosh, Wisconsin; central and northern Kentucky; Nashville and other localities in Tennessee; Ottawa, Canada.

otrypa mutabilis-minor Ulrich.

893. Eridotrypa mutabilis var. minor. Ulrich, Geol. Minnesota, III, p. 266, pl. xxvi, 20, 21, 29, 30.

Trenton: Cannon Falls and St. Paul, Minnesota.

Eridotrypa ? obliqua (Ulrich).

1890. Batostomella obliqua. Ulrich, Geol. Surv. Illinois, VIII, p. 433, 2-2*c*.
1893. Eridotrypa obliqua. Ulrich, Geol. Minnesota, III, p. 265.
Hamilton: Alpena, Michigan.

Eridotrypa simulatrix (Ulrich).

1890. Batostomella simulatrix. Ulrich, Geol. Surv. Illinois, VIII, p. xxxv, 1-1*g*.
1893. Eridotrypa simulatrix. Ulrich, Geol. Minnesota, III, p. 265.
1894. Monticulipora simulatrix. J. F. James, Jour. Cincinnati Soc. N XVI, p. 194.
Cincinnati (Richmond): Clarksville, Waynesville, and other loca Ohio; Weisberg and Versailles, Indiana; Savannah, Illinois.

Eridotrypa trentonensis (Nicholson).

1863. Stenopora fibrosa (not of Goldfuss). Billings, Geol. Canada, p. 15 [Foord].
1881. Monticulipora (Heterotrypa) Trentonensis. Nicholson, Genus M pora, p. 149, fig. 28.
1883. Monotrypella Trentonensis. Foord, Contr. Micro-Pal. Cambro-Sil.
1883. Monotrypella trentonensis. Ulrich, Jour. Cincinnati Soc. Nat. H p. 83.
Trenton: Peterboro, Ontario.

Eschara Lamarck. Not Paleozoic.

Eschara bifurcata Van Cleve (Mss.). See Pachydictya bifurcata

Eschara ? concentrica Prout. See Cystodictya ? concentrica (

Eschara ovatopora Troost. Not recognizable.

1840. Escharia ovatopora. Troost, Fifth Geol. Rep. Tennessee, p. 75.
Lower Silurian: Tennessee.

Eschara ramosa Van Cleve (Mss.). See Phænopora fimbriata (

Eschara reticulata Troost. Not recognizable.

1840. Escharia reticulata. Troost, Fifth Geol. Rep. Tennessee, p. 75.
Lower Silurian: Tennessee.

Eschara ? tuberculata Prout. Not recognizable.

1858. Eschara ? tuberculata. Prout, Trans. St. Louis Acad. Sci., I, p. 2
Carboniferous: Organ Mountains, New Mexico.

Escharina ? distorta James. See Rhinopora verrucosa Hall.

ESCHAROPORA Hall. Genotype: Escharopora recta Hall.

1847. Escharopora. Hall, Pal. New York, I, p. 72.
1860. Escharopora. Eichwald, Lethæa Rossica, I, p. 435.
1889. Escharopora. Miller, North American Geol. Pal., p. 301.
1893. Escharopora. Ulrich, Geol. Minnesota, III, p. 167.
1896. Escharopora. Ulrich, Zittel's Textb. Pal. (Engl. ed.), p. 279.
1886. Nicholsonia. Waagen and Wentzel, Pal. Indica, Ser. XIII, p. 87
Ptilodictya (in part). Various authors.

Escharopora acuminata (James).

1875. Ptilodictya acuminata. James, Catal. Foss. Cincinnati Group, p.
1893. Escharopora acuminata. Ulrich, Geol. Minnesota, III, p. 167.
Cincinnati (Utica): Cincinnati, Ohio, and vicinity.

aropora angularis Ulrich.

393. Escharopora angularis: Ulrich, Geol. Minnesota, III, p. 168, pl. xii, 1–4, 30, 31.

Trenton (Stones River): Minneapolis, Minnesota; High Bridge, Kentucky.

aropora (Ptilodictya) angusta Hall. See Ptilodictya angusta (Hall).

aropora (? Paleschara) bifoliata Hall. See Ptilodictya nebulosa all).

aropora briareus (Ulrich).

382. Ptilodictya briareus. Ulrich, Jour. Cincinnati Soc. Nat. Hist., V, p. 165, pl. vii, 6–6*b*.

393. Escharopora briareus. Ulrich, Geol. Minnesota, III, p. 167.

Trenton (Stones River): Lebanon, Shelbyville, and Columbia, Tennessee.

Obs. The form called by Safford Ptilodictya multiramis (not defined) is probably referable to this species.

aropora confluens Ulrich.

393. Escharopora confluens. Ulrich, Geol. Minnesota, III, p. 171, pl. xiii, 1–11.

Trenton (Black River): Minneapolis, Minnesota.

aropora falciformis (Nicholson).

349. Ptilodictya cruciformis. D'Orbigny, Prodr. de Pal., I, p. 21. (Not defined.)

375. Ptilodictya falciformis. Nicholson, Ann. Mag. Nat. Hist., ser. 4, XV, p. 177, pl. xiv, 1–1*b*.

375. Ptilodictya falciformis. Nicholson, Pal. Ohio, II, p. 259, pl. xxv, 7, 7*b*.

375. Ptilodictya falciformis. Nicholson, Pal. Province Ontario, p. 13, fig. 2.

383. Ptilodictya falciformis. (Van Cleve) Hall, Twelfth Ann. Rep. Indiana Geol. Nat. Hist., p. 265, pl. xii, 1.

393. Escharopora falciformis. Ulrich, Geol. Minnesota, III, p. 167.

381. Escharopora recta (not of Hall). Quenstedt, Roehren- und Sternkorallen, p. 94, pl. cxlvi, 69, 70.

379. Crateripora lineata. Ulrich, Jour. Cincinnati Soc. Nat. Hist., II, p. 30, pl. vii, 28, 28*a*.

379. Crateripora lineata var. expansa. Ulrich, Jour. Cincinnati Soc. Nat. Hist., II, p. 30.

Trenton: Peterboro and Ottawa, Ontario (Nicholson).

Cincinnati (Lorraine): Cincinnati, Ohio, and vicinity.

Obs. Crateripora lineata and var. expansa were applied to the articulating basal socket of this species before its true nature was known.

aropora hilli (James).

378. Ptilodictya Hilli. James, Paleontologist, No. 1, p. 4.

382. Ptilodictya hilli. Ulrich, Jour. Cincinnati Nat. Hist., V, pl. vii, 7, 7*a*.

385. Ptilodictya hilli. Nettleroth, Kentucky Fossil Shells, p. 30, pl. xxxv, 1, 2, 4, 5.

393. Escharopora hilli. Ulrich, Geol. Minnesota, III, p. 167.

Cincinnati (Lorraine): Bank of the Ohio River at Cincinnati, Ohio (James); Boyle and Lincoln counties, Kentucky.

aropora libana (Safford).

369. Ptilodictya ? libana. Safford, Geol. Tennessee, p. 286.

393. Escharopora libana. Ulrich, Geol. Minnesota, III, p. 167.

Trenton (Stones River): Lebanon, Tennessee.

Obs. At present this is not a valid species, but we recognize it because Mr. Ulrich has the types and will figure and describe them under the above name.

Escharopora ? limitaris Ulrich.

1893. Escharopora ? limitaris. Ulrich, Geol. Minnesota, III, p. 172, pl. xiii, 12, 13.

Trenton (Stones River and Black River): Minneapolis and Pres nesota.

Escharopora lirata Hall. See Phænopora lirata (Hall) and I pora granulosa (Hall).

Escharopora (Ptilodictya) lirata Hall. See Phænopora lirat and Dicranopora granulosa (Hall).

Escharopora maculata (Ulrich).

1882. Ptilodictya maculata. Ulrich, Jour. Cincinnati Soc. Nat. Hist., pl. vi, 17, pl. vii, 4, 4*a*.

1890. Ptilodictya maculata. Ulrich, Geol. Surv. Illinois, VIII, fig. 6*b* (

1893. Escharopora maculata. Ulrich, Geol. Minnesota, III, p. 167.

Cincinnati (Lorraine): Cincinnati, Ohio, and vicinity.

Escharopora nebulosa Hall. See Ptilodictya nebulosa (Hall).

Escharopora (Ptilodictya) nebulosa Hall. See Ptilodictya (Hall).

Escharopora pavonia (D'Orbigny).

1849. Ptilodictya pavonia. D'Orbigny, Prodr. de Pal., I, p. 22.

1851. Chætetes pavonia. Milne-Edwards and Haime, Pol. Foss. p. 267, pl. xix, 4, 4*a*.

1860. Monticulipora pavonia. Milne-Edwards, Hist. Nat. des Corall., I

1866. Chætetes pavonia. Rominger, Proc. Acad. Nat. Sci. Philadelph

1880. Heterodictya pavonia. Ulrich, Catal. Foss. Cincinnati Group, p.

1881. Chætetes pavonia. Quenstedt, Roehren- und Sternkorallen, p. 7 21-25.

1881. Monticulipora (Monotrypa) pavonia. Nicholson, Genus Mon p. 195, fig. 41, pl. vi, 3, 3*a*.

1882. Ptilodictya pavonia. Ulrich, Jour. Cincinnati Soc. Nat. Hist., pl. vii, 3-3*d*.

1888. Monticulipora pavonia. James and James, Jour. Cincinnati Hist., XI, p. 18.

1893. Escharopora pavonia. Ulrich, Geol. Minnesota, III, p. 167.

1895. Monticulipora pavonia. J. F. James, Jour. Cincinnati Soc. XVIII, p. 70.

1859. Cyclopora Jamesii. Prout, Trans. St. Louis Acad. Sci., I, p. 578.

1871. Stictopora clathratula. James, Catal. Foss. Cincinnati Grou defined).

1874. Chætetes ? clathratulus. Nicholson, Quar. Jour. Geol. Soc. XXX, p. 509, pl. xxx, 1-1*b*.

1875. Chætetes ? clathratulus. Nicholson, Pal. Ohio, II, p. 209, pl. xxii

1876. Chætetes ? clathratulus. Nicholson, Ann. Mag. Nat. Hist., ser. p. 91, pl. v, 9, 9*a*.

1886. Nicholsonia pavonica. Waagen and Wentzel, Pal. Indica, Ser. X

Cincinnati (Lorraine): Cincinnati, Ohio, and vicinity.

Escharopora ramosa (Ulrich).

1882. Ptilodictya ramosa. Ulrich, Jour. Cincinnati Soc. Nat. Hist., pl. vii, 5, 5*a*.

1893. Escharopora ramosa. Ulrich, Geol. Minnesota, III, p. 167.

ıropora ramosa (Ulrich)—Continued.

Trenton (Stones River): Lebanon, Tennessee; High Bridge, Kentucky. A variety, or perhaps new species, occurs in the Trenton of Deer Island, Lake Winnipeg, Canada.

aropora recta Quenstedt (not Hall). See Escharopora falciformis cholson).

ıropora recta Hall.

347. Escharopora recta. Hall, Pal. New York, I, p. 73, pl. xxvi, 1*a–g*.
Trenton: Middleville and Jacksonburg, New York.

ıropora recta-nodosa Hall.

347. Escharopora recta var. nodosa. Hall, Pal. New York, I, p. 73, pl. xxvi, 2.
Trenton: Middleville and Jacksonburg, New York.

ıropora subrecta (Ulrich).

386. Ptilodictya subrecta. Ulrich, Fourteenth Ann. Rep. Geol. Nat. Hist. Surv. Minnesota, p. 63.
393. Escharopora subrecta. Ulrich, Geol. Minnesota, III, p. 168, pl. xii, 5–29.
Trenton (Black River): Minneapolis and other localities in Minnesota; Decorah, Iowa; Beloit, Wisconsin.

aropora tenuis Hall. See Phænopora tenuis (Hall).

aropora (Ptilodictya) tenuis Hall. See Phænopora tenuis (Hall).

YDICTYA Ulrich. Genotype: Eurydictya montifera Ulrich.

390. Eurydictya. Ulrich, Geol. Surv. Illinois, VIII, pp. 389, 520.
389. Eurydictya. (Ulrich in press), Miller, North American Geol. Pal., p. 301.
393. Eurydictya. Ulrich, Geol. Minnesota, III, p. 138.
397. Eurydictya. Simpson, Fourteenth Ann. Rep. State Geologist New York for the year 1894, p. 527.

dictya calhounensis Ulrich.

390. Eurydictya calhounensis. Ulrich, Geol. Surv. Illinois, VIII, p. 520, pl. xxx, 4–4*c*.
Trenton: Port au Gres, Calhoun County, Illinois.

dictya montifera Ulrich.

390. Eurydictya montifera. Ulrich, Geol. Surv. Illinois, VIII, p. 521, pl. xxx, 3–3*d*.
397. Eurydictya montifera. Simpson, Fourteenth Ann. Rep. State Geologist New York for the year 1894, figs. 80–82 (p. 528).
Cincinnati (Richmond); Wilmington, Illinois.

dictya multipora (Hall).

351. Phænopora multipora. Hall, Foster and Whitney's Rep. Geol. Lake Superior Land District, Part 2, p. 206, pl. xxiv, 1*a*, *b*.
382. Phænopora ? multipora. Ulrich, Jour. Cincinnati Soc. Nat. Hist., V, p. 171, pl. viii, 7–7*b*.
390. Eurydictya multipora. Ulrich, Geol. Surv. Illinois, VIII, p. 520.
393. Eurydictya multipora (in part). Ulrich, Geol. Minnesota, III, p. 139, pl. vi, 9–11, pl. xiv, 9–11 (not pl. vii, 24, 29–31 = Rhinidictya fidelis Ulrich).
381. Ptilodictya antiqua. James, Paleontologist, No. 5, p. 37.
Trenton (Black River and Trenton): Escanaba River, Michigan (Hall); Burgin, Kentucky; Nashville, Tennessee; St. Paul, Minnesota.

Eurydictya sterlingensis Ulrich.

1890. Eurydictya sterlingensis. Ulrich, Geol. Surv. Illinois, VIII, p xxx, 2, 2*a*.

Cincinnati (Richmond): Sterling and South Elgin, Illinois.

EUSPILOPORA Ulrich. Genotype: **Euspilopora serrata** Ulric

1890. Euspilopora. Ulrich, Geol. Surv. Illinois, VIII, p. 389.

1889. Euspilopora. (Ulrich in press), Miller, North American G p. 301.

1896. Euspilopora. Ulrich, Zittel's Textb. Pal. (Engl. ed.), p. 280.

1897. Euspilopora. Simpson, Fourteenth Ann. Rep. State Geologist for the year 1894, p. 528.

Euspilopora ? barrisi Ulrich.

1890. Euspilopora ? barrisi. Ulrich, Geol. Surv. Illinois, VIII, p. 527, 5–5*d*.

1897. Euspilopora barrisi. Simpson, Fourteenth Ann. Rep. State New York for the year 1894, figs. 85, 86 (p. 529).

Hamilton: Buffalo, Iowa.

Euspilopora lobata (Hall and Simpson).

1887. Stictopora lobata. Hall and Simpson, Pal. New York, VI, p. 25

Hamilton: Reeds Corners, near Canandaigua Lake, New York.

Euspilopora palmipes (Hall).

1883. Stictopora palmipes. Hall, Trans. Albany Institute, X, p. 189 1881, p. 189).

1884. Stictopora palmipes. Hall, Rep. State Geologist New York for 1883, p. 41.

1887. Stictopora palmipes. Hall and Simpson, Pal. New York, VI, lx, 19, 20.

1890. Euspilopora palmipes. Ulrich, Geol. Surv. Illinois, VIII, p. 52

1891. Stictopora palmipes. Hall, Tenth Ann. Rep. State Geologist for the year 1890, p. 48; Forty-fourth Ann. Rep. New York St p. 78.

1897. Stictopora palmipes. Simpson, Fourteenth Ann. Rep. State New York for the year 1894, pl. x, 20.

1899. Stictopora palmipes. Grabau, Bull. Buffalo Soc. Nat. Sci., V fig. 69.

Hamilton: West Hamburg, Pavilion, and near Canandaigua L York.

Euspilopora serrata Ulrich.

1890. Euspilopora serrata. Ulrich, Geol. Surv. Illinois, VIII, p. 526, 4–4*h*.

1897. Euspilopora serrata. Simpson, Fourteenth Ann. Rep. State Geol York for the year 1894, figs. 83, 84 (p. 529).

Hamilton: Buffalo, Iowa; near Alpena, Michigan.

EVACTINOPORA Meek and Worthen. Genotype: Evactinopora Meek and Worthen.

1865. Evactinopora. Meek and Worthen, Proc. Acad. Nat. Sci. Phil p. 165.

1868. Evactinopora. Meek and Worthen, Geol. Surv. Illinois, III, p.

1884. Evactinopora. Ulrich, Jour. Cincinnati Soc. Nat. Hist., VII, p.

1889. Evactinopora. Miller, North American Geol. Pal., p. 301.

1890. Evactinopora. Ulrich, Geol. Surv. Illinois, VIII, pp. 387, 508.

1896. Evactinopora. Ulrich, Zittel's Textb. Pal. (Engl. ed.), p. 280.

ACTINOPORA Meek and Worthen—Continued.

1897. Evactinopora. Simpson, Fourteenth Ann. Rep. State Geologist New York for the year 1894, p. 529.

ctinopora grandis Meek and Worthen.

1868. Evactinopora grandis. Meek and Worthen, Geol. Surv. Illinois, III, p. 503, pl. xv, 2*a*, *b*.
1890. Evactinopora grandis. Ulrich, Geol. Surv. Illinois, VIII, p. 511, pl. lxxiii, 4.
1894. Evactinopora grandis. Keyes, Missouri Geol. Surv., V, p. 19.
Burlington: Burlington, Iowa; Montezuma, Illinois.

ctinopora quinqueradiata Ulrich.

1868. Evactinopora sexradiata (in part). Meek and Worthen, Geol. Surv. Illinois, III, pl. xvii, 3.
1890. Evactinopora quinqueradiata. Ulrich, Geol. Surv. Illinois, VIII, p. 510, pl. lxxiii, 1.
Burlington: Burlington, Iowa; Montezuma, Illinois.

ctinopora radiata Meek and Worthen.

1865. Evactinopora radiata. Meek and Worthen, Proc. Acad. Nat. Sci. Philadelphia, p. 165.
1868. Evactinopora radiata. Meek and Worthen, Geol. Surv. Illinois, III, p. 502, pl. xvii, 2*a*, *b*.
1884. Evactinopora radiata. Ulrich, Jour. Cincinnati Soc. Nat. Hist., VII, p. 42, pl. ii, 1–1*c*.
1890. Evactinopora radiata. Ulrich, Geol. Surv. Illinois, VIII, p. 509, pl. lxxiii, 3, 3*a*.
1894. Evactinopora radiata. Keyes, Missouri Geol. Surv., V, p. 19.
Keokuk: Missouri (Meek and Worthen); Kings Mountain, Kentucky (Ulrich).

ctinopora sexradiata Meek and Worthen.

1868. Evactinopora sexradiata. Meek and Worthen, Geol. Surv. Illinois, III, p. 502, pl. xvii, 3.
1890. Evactinopora sexradiata. Ulrich, Geol. Surv. Illinois, VIII, p. 510, pl. lxxiii, 2–2*b*.
1894. Evactinopora sexradiata. Keyes, Missouri Geol. Surv., V, p. 18.
Burlington: Burlington, Iowa.

VICELLA Hall and Simpson. Genotype: Thallostigma inclusa Hall.

1887. Favicella. Hall and Simpson, Pal. New York, VI, p. xviii.
1889. Favicella. Miller, North American Geol. Pal., p. 301.
1897. Favicella. Simpson, Fourteenth Ann. Rep. State Geologist New York for the year 1894, p. 556.
1897. Fistuliporidra. Simpson, Fourteenth Ann. Rep. State Geologist New York for the year 1894, p. 606.
Obs. This genus may be a synonym for Selenopora.

icella inclusa (Hall).

1883. Thallostigma inclusa. Hall, Trans. Albany Institute, X, p. 188 (abstract, 1881, p. 188).
1884. Thallostigma inclusapora (in error). Hall, Rep. State Geologist New York for the year 1883, p. 33.
1887. Favicella inclusa. Hall and Simpson, Pal. New York, VI, p. 234, pl. lviii, 21–23.
1897. Favicella inclusa. Simpson, Fourteenth Ann. Rep. State Geologist New York for the year 1894, pl. xxiv, 15–17.
Hamilton: York, New York.

Favicella tessellata (Hall and Simpson).

1887. Lichenalia tessellata. Hall and Simpson, Pal. New York, VI, p. 20
1888. Lichenalia tessellata. Hall, Seventh Ann. Rep. State Geologist New for the year 1887, pl. xv, 8–10; Forty-first Ann. Rep. New York Mus., pl. xv, 8–10.
1897. Fistuliporidra tessellata. Simpson, Fourteenth Ann. Rep. State Geo New York for the year 1894, pl. xxii, 1–3.
Hamilton: Genesee Valley, New York.

Favosites Lamarck. At present considered a coral by most aut

Favosites inexpectans Hall. See Monotrypa? helderbergiæ (Ha

Favosites lycopodites Vanuxem. Not recognizable.

1842. Favosites lycopodites. Vanuxem, Geol. Rep. Third District New p. 46, fig. 3.
Trenton: New York.

Favosites minimus Hall (Thirty-second Ann. Rep. New York Mus.). See Monotrypa spherica (Hall).

Favosites proximus Hall. See Monotrypa proxima (Hall).

Favosites sphericus Hall. See Monotrypa spherica (Hall).

FENESTELLA Lonsdale. (Not Fenestella Bolten 1798.) Geno Gorgonia antiqua Goldfuss. Accepted genotype: Fenestella pl McCoy.

1839. Fenestella. Lonsdale, Murchison's Silurian System, p. 677.
1841. Fenestella. Phillips, Pal. Foss., p. 22.
1844. Fenestella. McCoy, Synopsis Carb. Foss. Ireland, p. 200.
1845. Fenestella. Lonsdale, Russia and the Ural Mountains, I, Appen p. 629.
1850. Fenestella. King, Mon. Perm. Foss., p. 34.
1854. Fenestella. McCoy, British Pal. Foss., p. 49.
1860. Fenestella. Eichwald, Lethæa Rossica, I, p. 356.
1874. Fenestella. Nicholson, Pal. Province Ontario, p. 104.
1881. Fenestella. Shrubsole, Quar. Jour. Geol. Soc. London, XXXVII,
1882. Fenestella. Ulrich, Jour. Cincinnati Soc. Nat. Hist., V, p. 150.
1883. Fenestella. Claypole, Quar. Jour. Geol. Soc. London, XXXIX, p.
1885. Fenestella. Hall, Rep. State Geologist New York for the year 1884
1885. Fenestella. Waagen and Pichl, Pal. Indica, ser. XIII, pp. 773, 776.
1886. Fenestella. Ulrich, Contr. American Pal., I, p. 4.
1887. Fenestella. Foerste, Bull. Sci. Lab. Denison Univ., II, p. 83.
1887. Fenestella. Hall and Simpson, Pal. New York, VI, p. xxii.
1889. Fenestella. Miller, North American Geol. Pal., p. 302.
1890. Fenestella. Ulrich, Geol. Surv. Illinois, VIII, pp. 395, 534.
1894. Fenestella. Počta, Syst. Sil. Bohême, VIII, t. 1, p. 40.
1895. Fenestella. Whidborne, Devon. Fauna England, (Pal. Soc. Publ.), II p. 165.
1895. Fenestella. Simpson, Thirteenth Ann. Rep. State Geologist New Yo the year 1893, pp. 687, 724; Forty-seventh Ann. Rep. New York Mus., pp. 881, 918.
1896. Fenestella. Ulrich, Zittel's Textb. Pal. (Engl. ed.), p. 281.
1897. Fenestella. Simpson, Fourteenth Ann. Rep. State Geologist New Yo the year 1894, p. 500.
1899. Fenestella. Grabau, Bull. Buffalo Soc. Nat. Sci., VI, p. 159.
1850. Fenestrella (in error for Fenestella). D'Orbigny, Prodr. de Pal., I

ESTELLA Lonsdale—Continued.

1874. Actinostoma. Young and Young, Quar. Jour. Geol. Soc. London, XXX, p. 681.

885. Actinostoma. Vine, Proc. Yorkshire Geol. Polyt. Soc., IX, p. 84.

895. Flabelliporina. Simpson, Thirteenth Ann. Rep. State Geol. New York for the year 1893, pp. 703, 724; Forty-seventh Ann. Rep. New York State Mus., pp. 897, 918.

897. Flabelliporina. Simpson, Fourteenth Ann. Rep. State Geologist New York for the year 1894, p. 521.

Obs. See also remark on Palæocoryne Duncan and Jenkins.

estella (Hemitrypa) acaulis Hall. See Unitrypa acaulis (Hall).

estella (Unitrypa) acaulis Hall. See Unitrypa acaulis (Hall).

estella (Unitrypa) acaulis var. inclinis Hall. See Unitrypa acaulis- clinis (Hall).

estella (Unitrypa) acclivis Hall and Simpson. See Unitrypa clivis (Hall and Simpson).

estella acmea Hall. See Semicoscinium acmeum (Hall).

estella aculeata Hall. See Polypora aculeata (Hall).

estella (Polypora) aculeata Hall. See Polypora aculeata (Hall).

estella acuticosta Roemer.

860. Fenestella acuticosta. Roemer, Sil. Fauna West. Tennessee, p. 30, pl. ii, 15, 15*a*.

Niagara: Perry County, Tennessee.

estella adnata Hall. See Reteporidra adnata (Hall).

estella (Polypora) adnata Hall. See Reteporidra adnata (Hall).

stella adornata Hall and Simpson.

883. Fenestella sp. (?). Hall, Rep. State Geologist New York for the year 1882, pl. xxii, 7, 8.

887. Fenestella adornata. Hall and Simpson, Pal. New York, VI, p. 66, pl. xxii, 7, 8.

Lower Helderberg: Clarksville, New York.

stella adraste Hall.

879. Fenestella Adraste. Hall, Thirty-second Ann. Rep. New York State Mus., p. 169 (reprint, 1880, p. 31).

883. Fenestella Adraste. Hall, Rep. State Geologist New York for the year 1882, pl. xx, 20–22, 19 sp. (?).

887. Fenestella Adraste. Hall and Simpson, Pal. New York, VI, p. 48, pl. xx, 19–22.

Lower Helderberg: Clarksville, New York.

stella æqualis Hall.

883. Fenestella æqualis. Hall, Trans. Albany Institute, X, p. 173 (abstract, 1881, p. 31).

887. Fenestella æqualis. Hall and Simpson, Pal. New York, VI, p. 112, pl. xlvi, 27–31.

Hamilton: Falls of the Ohio. (In the Trans. Albany Institute, X, p. 173, the locality is given Clarence Hollow, New York.)

stella æsyle Hall.

879. Fenestella Æsyle. Hall, Thirty-second Ann. Rep. New York State Mus., p. 166 (reprint, 1880, p. 28).

Fenestella æsyle Hall—Continued.

1883. Fenestella Æsyle. Hall, Rep. State Geologist New York for th 1882, pl. xix, 11–13.

1887. Fenestella Æsyle. Hall and Simpson, Pal. New York, VI, p. xix, 11–13.

Lower Helderberg: Clarksville, New York.

Fenestella albida Hall.

1887. Fenestella albida. Hall, Sixth Ann. Rep. State Geologist New Y the year 1886, p. 48, pl. vii, 1–7.

1888. Fenestella albida. Ulrich, Bull. Denison Univ., IV, p. 65.

Waverly: Richfield, Ohio.

Fenestella albida var. richfieldensis Ulrich. See Fenestella richfi sis Ulrich.

Fenestella althæa Hall.

1879. Fenestella Althæa. Hall, Thirty-second Ann. Rep. New York Stat p. 166 (reprint, 1880, p. 28).

1883. Fenestella althæa. Hall, Rep. State Geologist New York for th 1882, pl. xix, 17–19.

1887. Fenestella althæa. Hall and Simpson, Pal. New York, VI, p. 48, 17–19.

Lower Helderberg: Albany County, New York.

Fenestella ambigua Hall. See Loculipora ambigua (Hall).

Fenestella angulata Hall. Not recognized.

1883. Fenestella angulata. Hall, Trans. Albany Institute, X, p. 170 (al 1881, p. 28).

Upper Helderberg: New York.

Fenestella angustata Hall.

1884. Fenestella angustata. Hall, Thirty-sixth Ann. Rep. New York Stat p. 60.

1887. Fenestella angustata. Hall, Sixth Ann. Rep. State Geologist New for the year 1886, p. 54.

1888. Fenestella angustata. Hall, Seventh Ann. Rep. State Geologist Ne for the year 1887, pl. viii, 1–8; Forty-first Ann. Rep. New Yor Mus., pl. viii, 1-8.

Hamilton: Alden, New York.

Fenestella (Hemitrypa) anonyma Hall. See Unitrypa anonyma (

Fenestella aperta Hall.

1887. Fenestella aperta. Hall, Sixth Ann. Rep. New York State Geolo the year 1886, p. 58, pl. iv, 1–5.

1888. Fenestella aperta. Ulrich, Bull. Denison Univ., IV, p. 66.

Waverly: Richfield, Ohio.

Fenestella arkonensis Whiteaves.

1874. Fenestella tenuiceps (not of Hall). Nicholson, Pal. Province Ont 106, fig. 44.

1898. Fenestella Arkonensis. Whiteaves, Contr. Canad. Pal., I, p. 379.

Hamilton: Near Arkona, Ontario.

Fenestella Arta Hall. See Polypora arta (Hall).

Fenestella (Polypora) Arta Hall. See Polypora arta (Hall).

Fenestella (Polypora) aspectans Hall. See Polypora aspectans (

nestella aspectus (in error for aspectans) Hall. See Polypora aspecans (Hall).

nestella assita Hall.

1884. Fenestella assita. Hall, Thirty-sixth Ann. Rep. New York State Mus., p. 64.
1887. Fenestella assita. Hall, Sixth Ann. Rep. State Geologist New York for the year 1886, p. 56, pl. vii, 8–11.
Hamilton: York, New York.

nestella banyana Prout.

1859. Fenestella banyana. Prout, Trans. St. Louis Acad. Sci., I, p. 450, pl. xviii, 4–4*b*.
1894. Fenestella banyana. Keyes, Missouri Geol. Surv., V, p. 23.
Warsaw: Barretts Station, Missouri.

nestella bellistriata Hall.

1883. Fenestella bellastriata. Hall, Trans. Albany Institute, X, p. 63 (abstract, 1879, p. 7).
1882. Fenestella bellastriata. Hall, Eleventh Ann. Rep. Indiana Geol. Nat. Hist., p. 252.
1890. Fenestella bellistriata (?). Ulrich, Geol. Surv. Illinois, VIII, pl. liv, 2.
Niagara: Waldron, Indiana.

nestella bicornis Spencer. Not recognizable.

1884. Fenestella bicornis. Spencer, Trans. St. Louis Acad. Sci., IV, p. 604, pl. vii, 2.
1884. Fenestella bicornis. Spencer, Bull. Mus. Univ. State Missouri, I, p. 55, pl. vii, 2.
Clinton: Hamilton, Ontario.

nestella bifurca Ulrich. See Ptiloporella ? bifurca (Ulrich).

nestella bifurcata Prout. Not recognizable; name also preoccupied y Roemer.

1866. Fenestella bifurcata. Prout, Trans. St. Louis Acad. Sci., II, p. 411.
Geological horizon and locality not given.

nestella bigeneris Ulrich. See Fenestella perplexa Hall.

nestella biimbricata Hall. See Semicoscinium biimbricatum (Hall).

nestella (Hemitrypa) biordo Hall and Simpson. See Hemitrypa iordo (Hall).

nestella (Hemitrypa) biserialis Hall. See Hemitrypa biserialis Hall).

nestella (Hemitrypa) biserialis var. exilis Hall. See Hemitrypa iserialis-exilis (Hall).

nestella biseriata Hall.

1883. Fenestella biseriata. Hall, Trans. Albany Institute, X, p. 166 (abstract, 1881, p. 25).
1887. Fenestella biseriata. Hall and Simpson, Pal. New York, VI, p. 113, pl. xlii, 16–18.
Upper Helderberg: Cherry Valley, New York.

nestella biserrulata Hall. See Semicoscinium biserrulatum (Hall).

nestella brevilinea Hall. See Semicoscinium exornatum (Hall).

nestella brevisulcata Hall. See Polypora brevisulcata (Hall).

Fenestella (Polypora) brevisulcata Hall. See Polypora brevis (Hall).

Fenestella burlingtonensis Ulrich.

1888. Fenestella burlingtonensis. Ulrich, Bull. Denison Univ., IV, p. 71.
1890. Fenestella burlingtonensis. Ulrich, Geol. Surv. Illinois, VIII, p. 5 xlix, 1, 1*a*.
Burlington: Burlington, Iowa.
Waverly: Lodi, Ohio.

Fenestella (Polypora) carinella Hall. See Polypora carinella and Simpson).

Fenestella cavernosa Ulrich.

1888. Fenestella cavernosa. Ulrich, Bull. Denison Univ., IV, p. 69, pl. xi
Waverly: Sciotoville, Ohio.

Fenestella celsipora Hall. See Polypora celsipora (Hall).

Fenestella (Polypora) celsipora Hall. See Polypora celsipora (

Fenestella celsipora var. minima Hall. See Polypora celsipora-m (Hall).

Fenestella (Polypora) celsipora var. minima Hall. See Pol celsipora-minima (Hall).

Fenestella celsipora var. minor Hall. See Polypora celsipora- (Hall).

Fenestella (Polypora) celsipora var. minor Hall. See Pol celsipora-minor (Hall).

Fenestella cestriensis Ulrich.

1890. Fenestella cestriensis. Ulrich, Geol. Surv. Illinois, VIII, p. 547, pl. l
1894. Fenestella cestriensis. Keyes, Missouri Geol. Surv., V, p. 24.
Chester: Chester, Kaskaskia, Anna, and other localities in Illinois; Valley and Litchfield, Kentucky.

Fenestella cinctuta Hall. See Reteporidra cinctuta (Hall).

Fenestella (Lyropora) cinctuta Hall. See Reteporidra cinctuta (

Fenestella cingulata Ulrich.

1890. Fenestella cingulata. Ulrich, Geol. Surv. Illinois, VIII, p. 543, pl. li
1894. Fenestella cingulata. Keyes, Missouri Geol. Surv., V, p. 23.
Keokuk: Nauvoo, Illinois; Keokuk, Iowa.

Fenestella (Loculipora) circumstata Hall and Simpson. See lipora circumstata (Hall and Simpson).

Fenestella clathrata Hall and Simpson.

1887. Fenestella clathrata. Hall and Simpson, Pal. New York, VI, p. 1
Upper Helderberg: Ontario, Canada.

Fenestella cleia Hall.

1879. Fenestella Cleia. Hall, Thirty-second Ann. Rep. New York Stat p. 169 (reprint, 1880, p. 31).
1883. Fenestella Cleia. Hall, Rep. State Geologist New York for the ye pl. xx, 14, 15.
1887. Fenestella Cleia. Hall and Simpson, Pal. New York, VI, p. 45, pl. xx
Lower Helderberg: Clarksville, New York.

Fenestella Cleis Hall. See Semicoscinium ? cleis (Hall).

stella (Reteporina) coalescens Hall and Simpson. See Reteporina lescens (Hall and Simpson).

stella (Hemitrypa) columellata Hall. See Hemitrypa columellata all).

stella compacta Hall. See Polypora compacta (Hall).

stella (Polypora) compacta Hall and Simpson. See Polypora comta (Hall).

stella compressa Hall. See Polypora compressa (Hall).

stella (Polypora) compressa Hall and Simpson. See Polypora npressa (Hall).

tella compressa Ulrich.

90. Fenestella compressa. Ulrich, Geol. Surv. Illinois, VIII, p. 539, pl. l, 2*a*.
Keokuk: Kings Mountain, Kentucky.

stella compressa var. nododorsalis Ulrich. See Fenestella nodosalis Ulrich.

stella conferta Hall. See Polypora conferta (Hall).

stella confertipora Hall and Simpson. See Ptiloporella ? bifurca rich).

stella (Ptiloporina) conica Hall and Simpson. See Ptiloporina ica (Hall and Simpson).

stella (Isotrypa) conjunctiva Hall and Simpson. See Isotrypa junctiva (Hall).

stella (Hemitrypa) conjunctiva Hall. See Isotrypa conjunctiva ll).

tella conradi Ulrich.

90. Fenestella conradi. Ulrich, Geol. Surv. Illinois, VIII, p. 553, pl. lii, 8, 8*a*.
Upper Coal Measures: Near Red Oak, Iowa.

stella (Unitrypa ?) consimilis Hall and Simpson. See Isotrypa similis (Hall and Simpson).

stella Coronis Hall. See Semicoscinium coronis (Hall).

tella corticata Prout.

59. Fenestella corticata. Prout, Trans. St. Louis Acad. Sci., I, p. 230.
Carboniferous: Organ Mountains, New Mexico.

stella crebescens Hall. See Polypora crebescens (Hall).

stella (Polypora) crebescens Hall and Simpson. See Polypora bescens (Hall).

tella crebripora Hall.

74. Fenestella crebripora. Hall, Twenty-sixth Ann. Rep. New York State Mus., p. 95.

79. Fenestella crebripora. Hall, Thirty-second Ann. Rep. New York State Mus., p. 167 (reprint, 1880, p. 29).

83. Fenestella crebripora. Hall, Rep. State Geologist New York for the year 1882, pl. xx, 1–3.

87. Fenestella crebripora. Hall and Simpson, Pal. New York, VI, p. 43, pl. xx, 1–3.
Lower Helderberg: Clarksville, New York.

Fenestella cribrosa Nicholson (not Hall). Name preoccupied by
See Fenestella nicholsoni Whiteaves.

Fenestella (Hemitrypa) cribrosa Hall. See Hemitrypa cribrosa (

Fenestella ? cribrosa Hall.

1852. Fenestella cribrosa. Hall, Pal. New York, II, p. 166, pl. xlD, 3*a*, *b*.
Niagara: Lockport, New York.

Fenestella cultellata Hall. See Polypora shumardi Prout.

Fenestella (Polypora) cultellata Hall. See Polypora shumardi P

Fenestella cultrata Hall.

1883. Fenestella cultrata. Hall, Trans. Albany Institute, X, p. 171 (a
1881, p. 29).

1886. Fenestella cultrata. Hall, Fifth Ann. Rep. State Geologist New Y
the year 1885, pl. l, 1–5.

1887. Fenestella cultrata. Hall and Simpson, Pal. New York, VI, p. 1
1–5.
Hamilton: Falls of the Ohio.

Fenestella curvata Hall.

1884. Fenestella curvata. Hall, Thirty-sixth Ann. Rep. New York Stat
p. 69.

1887. Fenestella curvata. Hall, Sixth Ann. Rep. State Geologist New Y
the year 1886, p. 50, pl. vi, 1–9.
Hamilton: Moscow, New York.

Fenestella curvijunctura Hall.

1883. Fenestella curvijunctura. Hall, Trans. Albany Institute. X,
(abstract, 1881, p. 29).

1887. Fenestella curvijunctura. Hall and Simpson, Pal. New York, VI,
pl. xlvi, 1–5.
Hamilton: Falls of the Ohio.

Fenestella cylindracea Hall. See Polypora cylindracea (Hall).

Fenestella Davidsoni Nicholson. See Semicoscinium davidsoni
olson.)

Fenestella delicata Meek.

1871. Fenestella delicata. Meek, Proc. Acad. Nat. Sci. Philadelphia, p.

1875. Fenestella delicata. Meek, Pal. Ohio, II, p. 273, pl. x, 2*a*–*d*.
Waverly: Lodi, Ohio.

Fenestella delicatula Ulrich.

1890. Fenestella delicatula. Ulrich, Geol. Surv. Illinois, VIII, p. 549, pl.
Base of Coal Measures: Seville, Illinois.

Fenestella depressa Hall.

1883. Fenestella depressa. Hall, Trans. Albany Institute, X, p. 172 (a
1881, p. 30).

1886. Fenestella depressa. Hall, Fifth Ann. Rep. State Geologist New Y
the year 1885, pl. xlv, 16, 17.

1887. Fenestella depressa. Hall and Simpson, Pal. New York, VI, p. 111,
16, 17.
Hamilton: Falls of the Ohio.

Fenestella dilata Prout.

1866. Fenestella dilata. Prout, Trans. St. Louis Acad. Sci., II, p. 411.
Hamilton: Locality not given (Buffalo, Iowa?).

stella dispanda Hall.
886. Fenestella dispanda. Hall, Fifth Ann. Rep. State Geologist New York for the year 1883, pl. xliv, 1–4.
887. Fenestella dispanda. Hall and Simpson, Pal. New York, VI, p. 114, pl. xliv, 1–4.
Upper Helderberg: Western New York.

estella (Ptiloporina) disparilis Hall and Simpson. See Ptiloporina sparilis (Hall and Simpson).

estella distans Hall. See Polypora distans (Hall).

estella (Polypora) distans Hall. See Polypora distans (Hall).

stella elegans Hall.
852. Fenestella elegans. Hall, Pal. New York, II, p. 164, pl. xlD, 1*a–g*.
Niagara: Lockport and Rochester, New York.

estella (Hemitrypa) elegantissima Hall. See Unitrypa ? elegansima (Hall).

estella (Unitrypa) elegantissima Hall. See Unitrypa ? elegansima (Hall).

stella elevatipora Ulrich.
890. Fenestella elevatipora. Ulrich, Geol. Surv. Illinois, VIII, p. 549, pl. li, 3, 3*a*.
894. Fenestella elevatipora. Keyes, Missouri Geol. Surv., V, p. 25.
Chester: Chester, Illinois; Crittenden County, Kentucky.

estella elongata Hall. See Polypora elongata (Hall).

estella (Polypora) elongata Hall. See Polypora elongata (Hall).

stella emaciata Hall.
884. Fenestella emaciata. Hall, Thirty-sixth Ann. Rep. New York State Mus., p. 68.
887. Fenestella emaciata. Hall, Sixth Ann. Rep. State Geologist New York, for the year 1886, p. 57.
888. Fenestella emaciata. Hall, Seventh Ann. Rep. State Geologist New York, for the year 1887, pl. viii, 9–13; Forty-first Ann. Rep. New York State Mus., pl. viii, 9–13.
899. Fenestella emaciata. Grabau, Bull. Buffalo Soc. Nat. Sci., VI, p. 159, fig. 47.
Hamilton: Shore of Seneca Lake, New York.

stella ? erectipora Hall.
883. Fenestella erectipora. Hall, Trans. Albany Institute, X, p. 174 (abstract, 1881, p. 33).
886. Fenestella erectipora. Hall, Fifth Ann. Rep. State Geologist New York, for the year 1885, pl. l, 15, 17.
887. Fenestella erectipora. Hall and Simpson, Pal. New York, VI, p. 118, pl. l, 15, 17.
Upper Helderberg: Near Buffalo, New York.

estella Eudora Hall. See Polypora eudora (Hall).

estella (Polypora) Eudora Hall and Simpson. See Polypora eudora Iall).

estella Eudora? Hall (1883). See Polypora ? stricta (Hall and mpson).

Fenestella exigua Ulrich.

1890. Fenestella exigua. Ulrich, Geol. Surv. Illinois, VIII, p. 545, pl. li, 1,
Warsaw: Monroe County, Illinois.

Fenestella eximia Winchell.

1866. Fenestella eximia. Winchell, Rep. Lower Penin. Michigan, p. 92.
Hamilton: Petoskey, Michigan.

Fenestella exornata Hall. See Semicoscinium exornatum (Hall).

Fenestella (Hemitrypa) fastigata Hall. See Unitrypa fastigata (

Fenestella (Unitrypa) fastigata Hall and Simpson. See Uni fastigata (Hall).

Fenestella (Hemitrypa) favosa Hall. See Hemitrypa favosa (Ha

Fenestella (Unitrypa) ficticius Hall and Simpson. See Unitrypa fi (Hall and Simpson).

Fenestella filiformis Nicholson. Not recognizable.

1874. Fenestella filiformis. Nicholson, Geol. Mag., new ser., I, p. 199, pl. i
1874. Fenestella filiformis. Nicholson, Pal. Province Ontario, p. 107, fig. 4
Upper Helderberg: Wainfleet, Ontario.
Obs. This form was founded upon the outer covering of some spe Unitrypa, which has probably since been described under a name.

Fenestella filistriata Ulrich.

1890. Fenestella filistriata. Ulrich, Geol. Surv. Illinois, VIII, p. 535, pl 2, 2*a*.
1894. Fenestella filistriata. Keyes, Missouri Geol. Surv., V, p. 22.
Burlington: Burlington, Iowa; Montezuma, Pike County, Illinois.

Fenestella filitexta Winchell.

1866. Fenestella filitexta. Winchell, Rep. Lower Penin. Michigan, p. 92.
Hamilton: Petoskey, Michigan.

Fenestella fistulata Hall. See Polypora fistulata (Hall).

Fenestella (Polypora) fistulata Hall. See Polypora fistulata (Hal

Fenestella flabelliformis Hall. See Polypora flabelliformis (Hall)

Fenestella (Polypora) flabelliformis Hall. See Polypora flabellif (Hall).

Fenestella flexuosa Ulrich. See Reteporina flexuosa (Ulrich).

Fenestella foliata Ulrich.

1888. Fenestella foliata. Ulrich, Bull. Denison Univ., IV, p. 67, pl. xiii,
Waverly: Cuyahoga Valley, Ohio.

Fenestella ? frequens Hall.

1888. Fenestella frequens. Hall, Seventh Ann. Rep. State Geologist New for the year 1887, pl. ix, 12-15; Forty-first Ann. Rep. New York Mus., pl. ix, 12-15.
Lower Helderberg: Clarksville, New York.

Fenestella funicula Ulrich.

1890. Fenestella funicula. Ulrich, Geol. Surv. Illinois, VIII, p. 542. pl. li
1894. Fenestella funicula. Keyes, Missouri Geol. Surv., V, p. 23.
Keokuk: Keokuk, Iowa.

Fenestella granifera Hall. See Semicoscinium graniferum (Hall stella (Hemitrypa) granifera Hall. See Semicoscinium granirum (Hall).

stella granilinea Hall. See Polypora granilinea (Hall).

stella (Polypora) granilinea Hall. See Polypora granilinea (Hall).

stella granulosa Whitfield.

878. Fenestella granulosa. Whitfield, Ann. Rep. Geol. Surv. Wisconsin for the year 1877, p. 68.

882. Fenestella granulosa. Whitfield, Geol. Surv. Wisconsin, IV, p. 252, pl. xii, 1, 2.

882. Fenestella oxfordensis. Ulrich, Jour. Cincinnati Soc. Nat. Hist., V, p. 159, pl. vi, 13.

Cincinnati (Richmond): Delafield, Wisconsin; Oxford and Oregonia, Ohio.

stella hemicycla Hall. See Semicoscinium labiatum (Hall).

stella hemitrypa Prout. See Hemitrypa proutana Ulrich.

stella herrickana Ulrich.

888. Fenestella herrickana. Ulrich, Bull. Denison Univ., IV, p. 63, pl. xiii, 2–2*d*.

Waverly: Moot's Run and Richfield, Ohio.

stella hestia Hall.

879. Fenestella Hestia. Hall, Thirty-second Ann. Rep. New York State Mus., p. 168 (reprint, 1880, p. 30).

883. Fenestella Hestia. Hall, Rep. State Geologist New York for the year 1882, pl. xx, 12, 13.

887. Fenestella Hestia. Hall and Simpson, Pal. New York, VI, p. 45, pl. xx, 12, 13.

Lower Helderberg: Schoharie, New York.

stella hexagonalis Hall. See Polypora hexagonalis (Hall).

stella (Polypora) hexagonalis Hall. See Polypora hexagonalis all).

stella hexagonalis var. foraminulosa Hall. See Polypora hexonalis-foraminulosa (Hall).

stella (Polypora) hexagonalis var. foraminulosa Hall. See Polyra hexagonalis-foraminulosa (Hall).

stella ? idalia Hall.

874. Fenestella Idalia. Hall, Twenty-sixth Ann. Rep. New York State Mus., p. 95.

879. Fenestella Idalia. Hall, Thirty-second Ann. Rep. New York State Mus., p. 170 (reprint, 1880, p. 32).

883. Fenestella Idalia. Hall, Rep. State Geologist New York for the year 1882, pl. xxi, 6–9.

887. Fenestella Idalia. Hall and Simpson, Pal. New York, VI, p. 52, pl. xxi, 6–9.

Lower Helderberg: Clarksville, New York.

stella Idothea Hall. See Polypora idothea (Hall).

stella (Polypora) Idothea Hall and Simpson. See Polypora idothea all).

stella inæqualis Ulrich.

890. Fenestella inæqualis. Ulrich, Geol. Surv. Illinois, VIII, p. 554, pl. lii, 9, 9*a*, pl. liv, 4, 4*a*.

Upper Coal Measures: Ball's Mill, Sangamon County, Illinois.

Fenestella (Ptiloporella) inæqualis Hall and Simpson. S
inæqualis (Hall and Simpson).

Fenestella incongruens Quenstedt. Not recognizable.

1881. Fenestella incongruens. Quenstedt, Roehren- und Ste
pl. cl, 3.

Upper Helderberg: Sandusky, Ohio.

Fenestella inflexa Hall. See Semicoscinium inflexum (

Fenestella intermedia Prout.

1858. Fenestella intermedia. Prout, Trans. St. Louis Acad. S

Carboniferous: Organ Mountains, New Mexico.

Fenestella interrupta Hall. See Semicoscinium interr

Fenestella juncea Hall.

1879. Fenestella junceus. Hall, Thirty-second Ann. Rep. New
p. 168 (reprint, 1880, p. 30).

1883. Fenestella junceus. Hall, Rep. State Geologist New
1882, pl. xx, 16–18.

1887. Fenestella junceus. Hall and Simpson, Pal. New York
16–18.

Lower Helderberg: Clarksville, New York.

Fenestella labiata Hall. See Semicoscinium labiatum (

Fenestella (Polypora) lævistriata Hall. See Polyp
(Hall).

Fenestella largissima Hall. See Polypora largissima (

Fenestella (Polypora) largissima Hall. See Polypora la

Fenestella (Hemitrypa) lata Hall. See Unitrypa lata (

Fenestella (Unitrypa) lata Hall and Simpson. See Unit

Fenestella laticarina Simpson. Not recognizable.

1897. Fenestella laticarina. Simpson, Fourteenth Ann. Re
New York for the year 1894, pl. ii, 12.

Obs. Simpson nowhere else alludes to this species, no
authorship. Geological horizon and locality are not

Fenestella (Ptiloporella) laticrescens Hall and Simpson
rella laticrescens (Hall and Simpson).

Fenestella latijunctura Hall. See Semicoscinium latiju

Fenestella latitruncata Hall. See Polypora latitruncat

Fenestella (Polypora) latitruncata Hall. See Polypo
(Hall).

Fenestella (Archimedes) laxa Hall. See Archimedes l

Fenestella levinodata Hall. See Polypora levinodata (

Fenestella (Polypora) levinodata Hall. See Polyp
(Hall).

Fenestella (Polypora) Lilæa Hall. See Polypora lilæa

Fenestella limbata Foerste.

1887. Fenestella limbatus. Foerste, Bull. Sci. Lab. Denison
vii, 10*a–d*.

Coal Measures: Flint Ridge, Ohio.

tella limbatus var. remotus Foerste. See Fenestella remota
rste.

tella limitaris Ulrich.
90. Fenestella limitaris. Ulrich, Geol. Surv. Illinois, VIII, p. 538, pl. xlix, 4, 4*a*.
94. Fenestella limitaris. Keyes, Missouri Geol. Surv., V, p. 23.
Keokuk: Keokuk and Bentonsport, Iowa.

tella lineanoda Hall. Not recognized.
83. Fenestella lineanoda. Hall, Trans. Albany Institute, X, p. 163 (abstract, 1881, p. 22).
Upper Helderberg: Locality not given.

tella (Tectulipora) loculata Hall. See Loculipora loculata (Hall).

tella lodiensis Meek.
75. Fenestella multiporata (McCoy) var. lodiensis. Meek, Pal. Ohio, II, p. 274, pl. x, 1*a*–*c*.
Waverly: Lodi, Ohio.

tella lunulata Hall. See Semicoscinium lunulatum (Hall).

tella lyelli Dawson.
78. Fenestella lyelli. Dawson, Acadian Geol., ed. 3, p. 288, fig. 86.
Carboniferous: Windsor and Stewiacke, Nova Scotia.

tella (Lyropora) lyra Hall. See Lyropora subquadrans-lyra
ll).

tella magnifica Nicholson.
74. Fenestella magnifica. Nicholson, Geol. Mag., new ser., I, p. 197, pl. ix, 22.
74. Fenestella magnifica. Nicholson, Pal. Province Ontario, p. 104, fig. 41*a*, *b*.
Upper Helderberg: Port Colborne, Ontario.

tella marcida Hall.
84. Fenestella marcida. Hall, Thirty-sixth Ann. Rep. New York State Mus., p. 61.
87. Fenestella marcida. Hall, Sixth Ann. Rep. State Geologist New York for the year 1886, p. 51, pl. vi, 10–15.
Hamilton: Darien and Moscow, New York.

tella marginalis Nicholson.
74. Fenestella marginalis. Nicholson, Geol. Mag., new ser., I, p. 197, pl. ix, 23.
74. Fenestella marginalis. Nicholson, Pal. Province Ontario, p. 105, fig. 42.
Upper Helderberg: Port Colborne, Ontario.

tella meekana Ulrich.
88. Fenestella meekana. Ulrich, Bull. Denison Univ., IV, p. 64, pl. xiii, 1–1*b*.
Waverly: Richfield and Lodi, Ohio.

tella (Archimedes) Meekana Hall. See Archimedes meekanus
ll).

tella microtrema D'Orbigny. Not recognizable.
50. Fenestrella microtrema. D'Orbigny, Prodr. de Pal., I, p. 45.
"Etats-Unis, Kentucky, failles de l'Ohio."

tella mimica Ulrich.
90. Fenestella mimica. Ulrich, Geol. Surv. Illinois, VIII, p. 552, pl. lii, 7, 7*a*.
Coal Measures: Seville, Illinois.

Fenestella modesta Ulrich.

1890. Fenestella modesta. Ulrich, Geol. Surv. Illinois, VIII, p. 550, pl.
Coal Measures: Knox County and Seville, Illinois.

Fenestella multiplex Hall. See Polypora multiplex (Hall).

Fenestella (Polypora) multiplex Hall. See Polypora multiplex

Fenestella multiporata (McCoy), var. lodiensis Meek. See Fe lodiensis Meek.

Fenestella multispinosa Ulrich.

1890. Fenestella multispinosa. Ulrich, Geol. Surv. Illinois, VIII, p. 1, 3–3*d*.

1894. Fenestella multispinosa. Keyes, Missouri Geol. Surv., V, p. 23.
Keokuk: Bentonsport and Keokuk, Iowa; Kings Mountain, Ken

Fenestella mutabilis Hall. See Polypora mutabilis (Hall).

Fenestella (Polypora) mutabilis Hall. See Polypora mutabilis

Fenestella (Unitrypa) nana Hall and Simpson. See Unitryp Hall and Simpson.

Fenestella nervata Nicholson. See Ptiloporella nervata (Nich

Fenestella Nervia Hall. See Unitrypa nervia (Hall).

Fenestella (Hemitrypa) Nervia Hall. See Unitrypa nervia (Ha

Fenestella (Unitrypa) Nervia Hall and Simpson. See Unitrypa (Hall).

Fenestella (Hemitrypa) Nervia var. constricta Hall. See U nervia-constricta (Hall).

Fenestella (Unitrypa) Nervia var. constricta Hall and Simpso Unitrypa nervia-constricta (Hall).

Fenestella nexa Hall. See Polypora nexa (Hall).

Fenestella (Polypora) nexa Hall. See Polypora nexa (Hall).

Fenestella ? nexilis Hall.

1888. Fenestella nexilis. Hall, Seventh Ann. Rep. State Geologist N for the year 1887, pl. x, 14, 15; Forty-first Ann. Rep. New Y Mus., pl. x, 14, 15.
Upper Helderberg: Locality not given.

Fenestella nicholsoni Whiteaves.

1874. Fenestella cribrosa (not of Hall). Nicholson, Pal. Province O 106, fig. 43.

1898. Fenestella Nicholsoni. Whiteaves, Contr. Canad. Pal., I, p. 378.
Hamilton: Widder and near Arkona, Ontario.

Fenestella nododorsalis Ulrich.

1890. Fenestella compressa var. nododorsalis. Ulrich, Geol. Surv. Illin p. 540, pl. 1, 2.
Keokuk: Kings Mountain, Kentucky.

Fenestella nodosa Prout.

1866. Fenestella nodosa. Prout, Trans. St. Louis Acad. Sci., II, p. 410.
Hamilton: Locality not given; (Buffalo, Iowa ?).

Fenestella noe Hall and Simpson.

1883. Fenestella sp. Hall, Rep. State Geologist New York for the year xiii, 19–22.

tella noe Hall and Simpson—Continued.

87. Fenestella Noe. Hall and Simpson, Pal. New York, VI, p. 47, pl. xiii, 19–22.
Lower Helderberg: Clarksville, New York.

stella normalis Hall. Not recognizable.

85. Fenestella normalis. Hall, Rep. State Geologist New York for the year 1884, pl. i, 8.
Geological horizon and locality not given.

tella norwoodiana Prout.

58. Fenestella Norwoodiana. Prout, Trans. St. Louis Acad. Sci., I, p. 233.
Carboniferous: Organ Mountains, New Mexico.

stella obliqua Hall. See Polypora obliqua (Hall and Simpson).

stella (Polypora) obliqua Hall and Simpson. See Polypora obli-
(Hall and Simpson).

stella (Archimedes) Owenana Hall. See Archimedes owenanus
ll).

stella oxfordensis Ulrich. See Fenestella granulosa Whitfield.

stella papillata Hall. See Polypora paxillata (Hall).

stella parallela Hall (1881). Not recognized.

33. Fenestella parallela. Hall, Trans. Albany Institute, X, p. 168 (abstract, 1881, p. 26).
Upper Helderberg: New York.

stella parallela Hall (1888). See Loculipora loculata (Hall).

tella parallela Hall.

35. Fenestella parallela. Hall, Rep. State Geologist New York for the year 1884, pl. i, 7.

36. Fenestella parallela. Hall, Fifth Ann. Rep. State Geologist New York for the year 1885, pl. xliv, 8–18.

37. Fenestella parallela. Hall and Simpson, Pal. New York, VI, p. 107, pl. xliv, 8–18.
Upper Helderberg: Near Buffalo, New York.

tella parvulipora Hall.

76. Fenestella parvulipora. Hall, Twenty-eighth Ann. Rep. New York State Museum (documentary edition), pl. xii, 1–9; ibid. (Museum edition), 1879, p. 123, pl. xii, 1–9.

32. Fenestella parvulipora. Hall, Eleventh Ann. Rep. Indiana Geol. Nat. Hist., p. 249, pl. xi, 1–9.
Niagara: Waldron, Indiana.

tella patellifera Ulrich. See Fenestella variapora Hall.

tella paxillata Hall. See Polypora paxillata (Hall).

tella (Polypora) paxillata Hall and Simpson. See Polypora pax-
ta (Hall).

ella peculiaris Hall.

33. Fenestella peculiaris. Hall, Rep. State Geologist New York for the year 1882, pl. (42) xxxiii, 19–21.

37. Fenestella peculiaris. Hall and Simpson, Pal. New York, VI, p. 113, pl. xlii, 19–21.
Upper Helderberg: Near Caledonia, New York.

tella perangulata Hall. See Polypora perangulata (Hall).

Fenestella (Polypora) perangulata Hall. See Polypora perangulata (Hall).

Fenestella perelegans Meek.

1872. Fenestella perelegans. Meek, Pal. Eastern Nebraska, p. 153, pl. vii, 3–*3d*. (Proposed under F. Shumardii Meek (not Prout).)

1885. Fenestella perelegans. Waagen and Pichl, Pal. Indica, Ser. XIII, p. 777, pl. lxxxvii, 1–3.

1894. Fenestella shumardi (not of Prout). Keyes, Missouri Geol. Surv., V, p. 24, pl. xxxiv, *2a*, *b*.

1896. Fenestella shumardi (not of Prout). Smith, Proc. American Phil. Soc., xxxv, p. 237.

Coal Measures: Nebraska City, Nebraska; Poteau Mountain, Indian Territory (Smith).

Fenestella perforata Hall. See Loculipora perforata (Hall).

Fenestella (Loculipora) perforata Hall. See Loculipora perforata (Hall).

Fenestella permarginata Hall. See Semicoscinium permarginatum (Hall).

Fenestella perminuta Ulrich.

1890. Fenestella perminuta. Ulrich, Geol. Surv. Illinois, VIII, p. 551, pl. lii, 4–*4b*.

Coal Measures: Seville, Illinois.

Fenestella (Hemitrypa) pernodosa Hall. See Unitrypa pernodosa (Hall).

Fenestella (Unitrypa) pernodosa Hall. See Unitrypa pernodosa (Hall).

Fenestella perplexa Hall.

1883. Fenestella (Hemitrypa) perplexa. Hall, Trans. Albany Institute, X, p. 175 (abstract, 1881, p. 33).

1887. Fenestella perplexa. Hall and Simpson, Pal. New York, VI, p. 130.

1888. Fenestella perplexa. Hall, Seventh Ann. Rep. State Geologist New York for the year 1887, pl. xiv, 5; Forty-first Ann. Rep. New York State Mus., pl. xiv, 5.

1886. Fenestella bigeneris. Ulrich, Contr. American Pal., I, p. 11, pl. ii, 1, *1a*.

Hamilton: Falls of the Ohio.

Fenestella (Hemitrypa) perplexa Hall. See Fenestella perplexa Hall.

Fenestella pertenuis Hall (1881). See Fenestella proutana Miller.

Fenestella pertenuis Hall.

1883. Fenestella pertenuis. Hall, Trans. Albany Institute, X, p. 62 (abstract, 1879, p. 6).

1882. Fenestella pertenuis. Hall, Eleventh Ann. Rep. Indiana Geol. Nat. Hist., p. 251.

Niagara: Waldron, Indiana.

Fenestella perundata Hall. See Reteporidra perundata (Hall).

Fenestella (Polypora) perundata Hall and Simpson. See Reteporidra perundata (Hall).

Fenestella perundulata Hall. See Reteporina perundulata (Hall).

stella philia Hall.

379. Fenestella Philia. Hall, Thirty-second Ann. Rep. New York State Mus., p. 168 (reprint, 1880, p. 30).

383. Fenestella Philia. Hall, Rep. State Geologist New York for the year 1882, pl. xx, 9–11.

387. Fenestella Philia. Hall and Simpson, Pal. New York, VI, p. 50, pl. xx, 9–11.

Lower Helderberg: Clarksville, New York.

stella (Ptiloporina) pinnata Hall and Simpson. See Ptiloporina nnata Hall and Simpson.

stella planiramosa Hall (Lower Helderberg). See Polypora mpressa (Hall).

stella planiramosa Hall.

384. Fenestella planiramosa. Hall, Thirty-sixth Ann. Rep. New York State Mus., p. 62.

387. Fenestella planiramosa. Hall, Sixth Ann. Rep. State Geologist New York for the year 1886, p. 44, pl. i, 1–13.

899. Fenestella planiramosa. Grabau, Bull. Buffalo Soc. Nat. Sci., VI, p. 159, fig. 48.

Hamilton: Bellona and Eighteenmile Creek, New York.

stella plumosa Prout. See Hemitrypa plumosa (Prout).

stella popeana Prout.

358. Fenestella Popeana. Prout, Trans. St. Louis Acad. Sci., I, p. 229; ibid., p. 388.

Permian: Guadalupe Mountains, New Mexico.

stella porosa Hall. See Polypora porosa (Hall.)

stella (Polypora) porosa Hall. See Polypora porosa (Hall).

stella præcursor Hall. See Unitrypa præcursor (Hall).

stella (Unitrypa) præcursor Hall. See Unitrypa præcursor (Hall).

stella prisca? Hall (not Lonsdale nor Goldfuss). See Semiconium tenuiceps (Hall).

stella proceritas Hall and Simpson.

387. Fenestella proceritas. Hall and Simpson, Pal. New York, VI, p. 115, pl. xlvi, 32, 35, 36.

Upper Helderberg: Walpole, Ontario.

stella (Unitrypa) projecta Hall and Simpson. See Unitrypa acaulis all).

stella prolixa Hall.

383. Fenestella prolixa. Hall, Trans. Albany Institute, X, p. 64 (abstract, 1879, p. 8).

382. Fenestella prolixa. Hall, Eleventh Ann. Rep. Indiana Geol. Nat. Hist., p. 253.

Niagara: Waldron, Indiana.

stella propria Hall. See Polypora propria (Hall).

stella (Polypora) propria Hall and Simpson. See Polypora proia (Hall).

Fenestella proutana Miller.

1883. Fenestella pertenuis. Hall, Trans. Albany Institute, X, p. 171 (abstract, 1881, p. 29).

1886. Fenestella pertenuis. Hall, Fifth Ann. Rep. State Geologist New York for the year 1885, pl. xlv, 22, 23.

1887. Fenestella pertenuis. Hall and Simpson, Pal. New York, VI, p. 106, pl. xlv, 22, 23.

1883. Fenestella proutana. Miller, American Pal. Foss., ed. 2, p. 291. (Name proposed for F. pertenuis, preoccupied by Hall for a species from the Niagara at Waldron, Indiana).

Hamilton: Falls of the Ohio.

Fenestella pulchella Ulrich.

1886. Fenestella pulchella. Ulrich, Contr. American Pal., I, p. 9, pl. i, 4, 4*a*.

Hamilton: Falls of the Ohio.

Fenestella punctostriata Hall. See Polypora punctostriata (Hall).

Fenestella quadrangula Hall.

1884. Fenestella quadrangula. Hall, Thirty-sixth Ann. Rep. New York State Mus., p. 68.

1887. Fenestella quadrangula. Hall, Sixth Ann. Rep. State Geologist New York for the year 1886, p. 47, pl. iii, 7–12.

Hamilton: Darien, New York.

Fenestella quadrangularis Hall. See Polypora quadrangularis (Hall).

Fenestella (Polypora) quadrangularis Hall. See Polypora quadrangularis (Hall).

Fenestella quadrula Hall. See Unitrypa quadrula (Hall).

Fenestella (Lyropora) quincuncialis Hall. See Lyropora quincuncialis (Hall).

Fenestella regalis Ulrich.

1890. Fenestella regalis. Ulrich, Geol. Surv. Illinois, VIII, p. 538, pl. l, 1, 1*a*, pl. liv, 5.

Keokuk: Kings Mountain, Kentucky.

Fenestella regalis-macra Ulrich.

1888. Fenestella regalis var. macra. Ulrich, Bull. Denison Univ., IV, p. 70, pl. xiii, 5, 5*a*.

Waverly: Richfield, Ohio.

Fenestella remota Foerste.

1887. Fenestella limbatus var. remotus. Foerste, Bull. Sci. Lab. Denison Univ., II, p. 84, pl. vii, 11.

1887. Fenestella remota. Foerste, Bull. Sci. Lab. Denison Univ., II, p. 87.

Coal Measures: Flint Ridge, Ohio.

Fenestella (Lyropora) retrorsa Meek and Worthen. See Lyropora retrorsa (Meek and Worthen).

Fenestella rhombifera Hall. See Reteporina rhombifera (Hall).

Fenestella (Reteporina) rhombifera Hall and Simpson. See Reteporina rhombifera (Hall).

Fenestella richfieldensis Ulrich.

1888. Fenestella albida var. richfieldensis. Ulrich, Bull. Denison Univ., IV, p. 66, pl. xiii, 3–3*c*.

Waverly: Richfield, Ohio.

estella rigida Hall. See Polypora rigida (Hall).

estella (Polypora) rigida Hall. See Polypora rigida (Hall).

estella robusta Hall. See Polypora robusta (Hall).

estella (Polypora) robusta Hall. See Polypora robusta (Hall).

stella rudis Ulrich.

890. Fenestella rudis. Ulrich, Geol. Surv. Illinois, VIII, p. 537, pl. xlix, 3–3*d*.
894. Fenestella rudis. Keyes, Missouri Geol. Surv., V, p. 23, pl. xxxiv, 5.
Keokuk: Keokuk and Bentonsport, Iowa.
Warsaw: Warsaw and Nauvoo, Illinois.

estella (Polypora) rustica Hall and Simpson. See Polypora rustica Iall and Simpson).

estella scalaris Hall. See Unitrypa scalaris (Hall).

estella (Unitrypa) scalaris Hall. See Unitrypa scalaris (Hall).

estella sculptilis Ulrich. See Fenestella stellata Hall.

estella semirotunda Hall. See Semicoscinium semirotundum (Hall).

estella (Polypora) separata Hall. See Polypora separata (Hall).

stella serrata Hall.

883. Fenestella serrata. Hall, Trans. Albany Institute, X, p. 170 (abstract, 1881, p. 28).
887. Fenestella serrata. Hall and Simpson, Pal. New York, VI, p. 110, pl. xlvii, 11–19.
Hamilton: Falls of the Ohio.

stella serratula Ulrich.

890. Fenestella serratula. Ulrich, Geol. Surv. Illinois, VIII, p. 544, pl. l, 5–5*c*.
894. Fenestella serratula. Keyes, Missouri Geol. Surv., V, p. 23.
Keokuk: Nauvoo, Illinois.
Warsaw: Warsaw and Monroe County, Illinois.
St. Louis: Caldwell, Lyon, and Crittenden counties, Kentucky.
Chester: Sloans Valley, Kentucky.

stella sevillensis Ulrich.

890. Fenestella sevillensis. Ulrich, Geol. Surv. Illinois, VIII, p. 552, pl. lii, 6, 6*a*.
Base of Coal Measures: Seville, Illinois.

stella shumardi Prout.

858. Fenestella Shumardii. Prout, Trans. St. Louis Acad. Sci., I, p. 232.
Carboniferous: Organ Mountains, New Mexico.

estella Shumardii Meek and other authors (not Prout). See Fenestella perelegans Meek.

estella singularis Hall. See Fenestella singularitas Hall.

stella singularitas Hall.

883. Fenestella singularis. Hall, Trans. Albany Institute, X, p. 171 (Fenestella singularitas, abstract, 1881, p. 29).
887. Fenestella singularitas. Hall and Simpson, Pal. New York, VI, p. 114, pl. xlvi, 12–16.
Hamilton: Falls of the Ohio.

estella (Ptiloporina) sinistralis Hall and Simpson. See Ptiloporina nistralis (Hall and Simpson).

Fenestella sinuosa Hall.

1886. Fenestella sinuosa. Hall, Fifth Ann. Rep. State Geologist New York for the year 1885, pl. xliv, 5, 6.
1887. Fenestella sinuosa. Hall and Simpson, Pal. New York, VI, p. 116, pl. xliv, 5, 6.
Upper Helderberg: Near Caledonia, New York.

Fenestella spio Hall and Simpson.

1883. Fenestella sp. (?). Hall, Rep. State Geologist New York for the year 1882, pl. xix, 16.
1887. Fenestella Spio. Hall and Simpson, Pal. New York, VI, p. 47, pl. xix, 16.
Lower Helderberg: Clarksville, New York.

Fenestella spissa Hall.

1887. Fenestella spissa. Hall, Sixth Ann. Rep. State Geologist New York for the year 1886, p. 59.
Hamilton: West Bloomfield, New York.

Fenestella stellata Hall.

1883. Fenestella stellata. Hall, Trans. Albany Institute, X, p. 170 (abstract, 1881, p. 29).
1886. Fenestella stellata. Hall, Fifth Ann. Rep. State Geologist New York for the year 1885, pl. xlv, 14, 15.
1887. Fenestella stellata. Hall and Simpson, Pal. New York, VI, p. 109, pl. xlv, 14, 15, pl. xlvii, 20–36.
1897. Fenestella stellata. Simpson, Fourteenth Ann. Rep. State Geologist New York for the year 1894, pl. ii, 5.
1886. Fenestella sculptilis. Ulrich, Contr. American Pal., I, p. 10, pl. i, 3.
Hamilton: Falls of the Ohio.

Fenestella (Hemitrypa) stipata Hall. See Unitrypa tegulata (Hall).

Fenestella (Unitrypa) stipata Hall. See Unitrypa tegulata (Hall).

Fenestella strata Hall. See Reteporina striata (Hall).

Fenestella (Reteporina) striata Hall. See Reteporina striata (Hall).

Fenestella striatopora Hall. See Polypora striatopora (Hall).

Fenestella (Polypora) striatopora Hall. See Polypora striatopora (Hall).

Fenestella (Polypora) stricta Hall and Simpson. See Polypora? stricta (Hall and Simpson).

Fenestella subflexuosa Ulrich.

1888. Fenestella subflexuosa. Ulrich, Bull. Denison Univ., IV, p. 68, pl. xiii, 6.
Waverly: Cuyahoga Falls, Ohio.

Fenestella submutans Hall. See Polypora submutans (Hall).

Fenestella (Polypora) submutans Hall. See Polypora submutans (Hall).

Fenestella (Lyropora) subquadrans Hall. See Lyropora subquadrans (Hall).

Fenestella subretiformis Prout.

1858. Fenestella subretiformis. Prout, Trans. St. Louis Acad. Sci., I, p. 233.
Carboniferous: Organ Mountains, New Mexico.

Fenestella (Hemitrypa) substriata Hall. See Unitrypa substriata (Hall).

Fenestella subtortilis Hall. See Semicoscinium subtortile (Hall).

Fenestella (Archimedes) Swallovana Hall. See Archimedes swallovanus (Hall).

tella sylvia Hall.

74. Fenestella Sylvia. Hall, Twenty-sixth Ann. Rep. New York State Mus., p. 96.
79. Fenestella Sylvia. Hall, Thirty-second Ann. Rep. New York State Mus., p. 167 (reprint, 1880, p. 29).
83. Fenestella Sylvia. Hall, Rep. State Geologist New York for the year 1882, pl. xx, 4–7.
87. Fenestella Sylvia. Hall and Simpson, Pal. New York, VI, p. 49, pl. xx, 4–7.
Lower Helderberg: Clarksville, New York.

stella tantulus Hall. See Polypora tantula (Hall).

stella (Hemitrypa) tegulata Hall. See Unitrypa tegulata (Hall).

stella (Unitrypa) tegulata Hall. See Unitrypa tegulata (Hall).

tella tenax Ulrich.

88. Fenestella tenax. Ulrich, Bull. Denison Univ., IV, p. 71.
90. Fenestella tenax. Ulrich, Geol. Surv. Illinois, VIII, p. 546, pl. li, 2–2*e*.
94. Fenestella tenax. Keyes, Missouri Geol. Surv., V, p. 24.
Warsaw: Warsaw, and Monroe County, Illinois.
Chester: Chester and Kaskaskia, Illinois; Sloans Valley, Kentucky.
Waverly: Cuyahoga County, Ohio.

tella tenella Hall.

86. Fenestella tenella. Hall, Fifth Ann. Rep. State Geologist New York for the year 1885, pl. xlv, 18, 19.
87. Fenestella tenella. Hall and Simpson, Pal. New York, VI, p. 105, pl. xlv, 18, 19.
Hamilton: Falls of the Ohio.

stella tenuiceps Hall. See Semicoscinium tenuiceps (Hall).

stella tenuiceps Nicholson (not Hall). See Fenestella arkonensis iteaves.

tella tenuis Hall.

52. Fenestella tenuis. Hall, Pal. New York, II, p. 51, pl. xix, 5*a*–*c*.
Clinton: Wolcott Furnace, Whiting's Mill, Wayne County, New York.

stella Thyene Hall. See Semicoscinium thyene (Hall).

stella torta Hall. See Semicoscinium tortum (Hall).

stella (Unitrypa) transversa Hall and Simpson. See Unitrypa ulata (Hall).

tella triserialis Ulrich.

90. Fenestella triserialis. Ulrich, Geol. Surv. Illinois, VIII, p. 541, pl. l, 4, 4*a*.
Keokuk: Kings Mountain, Kentucky.

tella trituberculata Prout.

58. Fenestella trituberculata. Prout, Trans. St. Louis Acad. Sci., I, p. 228.
Carboniferous: Organ Mountains, New Mexico.

tella tuberculata Hall and Simpson.

87. Fenestella tuberculata. Hall and Simpson, Pal. New York, VI, p. 116, pl. xlvi, 25, 26, 33, 34.
Upper Helderberg: Ontario.

stella varia Hall. See Polypora varia (Hall).

tella variabilis Prout.

58. Fenestella variabilis. Prout, Trans. St. Louis Acad. Sci., I, p. 231.
Carboniferous: Organ Mountains, New Mexico.

Fenestella variapora Hall.
1883. Fenestella variapora. Hall, Trans. Albany Institute
1881, p. 28).
1886. Fenestella variapora. Hall, Fifth Ann. Rep. State
for the year 1885, pl. xlv, 1–13.
1887. Fenestella variapora. Hall and Simpson, Pal. New
xxxv, 17, pl. xlv, 1–13.
1897. Fenestella variapora. Simpson, Fourteenth Ann.
New York for the year 1894, pl. ii, 18.
1886. Fenestella patellifera. Ulrich, Contr. American Pal
Hamilton: Falls of the Ohio.

Fenestella vera Ulrich.
1890. Fenestella vera. Ulrich, Geol. Surv. Illinois, VIII,
pl. liv, 3.
1892. Fenestella vera. Whiteaves, Contr. Canadian Pal.,
3, 3*a*.
Hamilton: Buffalo, Iowa; Lake Winnipegosis, Cana

Fenestella verrucosa Hall.
1883. Fenestella (Polypora) verrucosa. Hall, Rep. State
for the year 1882, pl. (42) xxxiii, 11.
1887. Fenestella verrucosa. Hall and Simpson, Pal. New
xlii, 11, pl. xlvi, 22–24.
Hamilton: Falls of the Ohio.

Fenestella (Polypora) verrucosa Hall. See Fenestel

Fenestella wortheni Ulrich.
1890. Fenestella wortheni. Ulrich, Geol. Surv. Illinois,
5, 5*a*.
Base of Coal Measures: Seville, Illinois.

Fenestella (Archimedes) Wortheni Hall. See Arc
(Hall).

FENESTRALIA Prout. Genotype: Fenestralia sanc
1858. Fenestralia. Prout, Trans. St. Louis Acad. Sci., I,
1882. Fenestralia. Ulrich, Jour. Cincinnati Soc. Nat. Hist
1885. Fenestralia. Waagen and Pichl, Pal. Indica, Ser. X
1885. Fenestralia. Hall, Rep. State Geologist New York fo
1886. Fenestralia. Ulrich, Contr. American Pal., I, p. 5.
1889. Fenestralia. Miller, North American Geol. Pal., p.
1890. Fenestralia. Ulrich, Geol. Surv. Illinois, VIII, pp.
1895. Fenestralia. Simpson, Thirteenth Ann. Rep. State
for the year 1893, pp. 717, 724; Forty-seventh A
State Mus., pp. 911, 918.
1896. Fenestralia. Ulrich, Zittel's Textb. Pal. (Eng. ed.),
1897. Fenestralia. Simpson, Fourteenth Ann. Rep. State
for the year 1894, pp. 502, 520.

Fenestralia compacta Ulrich.
1890. Fenestralia sancti-ludovici var. compacta. Ulrich,
VIII, p. 605, pl. lix, 1.
St. Louis: Elizabethtown, Kentucky.

Fenestralia sancti-ludovici Prout.
1858. Fenestralia St. Ludovici. Prout, Trans. St. Louis
pl. xv, 1, 1*a*.

tralia sancti-ludovici Prout—Continued.

90. Fenestralia sancti-ludovici. Ulrich, Geol. Surv. Illinois, VIII, p. 604, pl. lv, 5.
94. Fenestralia sancti-ludovici. Keyes, Missouri Geol. Surv., V, p. 30.
95. Fenestralia St. Ludovici. Simpson, Thirteenth Ann. Rep. State Geologist New York for the year 1893, fig. 62 (p. 717).
97. Fenestralia St. Ludovici. Simpson, Fourteenth Ann. Rep. State Geologist New York for the year 1894, figs. 42, 43 (p. 503).
Warsaw: Barrett's Station, Missouri; Warsaw and Columbia, Illinois.
St. Louis: St. Louis, Missouri; Alton, Illinois.

stralia sancti-ludovici var. compacta Ulrich. See Fenestralia npacta Ulrich.

ESTRAPORA Hall. Genotype: Fenestrapora biperforata Hall.

85. Fenestrapora. Hall, Rep. State Geologist New York for the year 1884, p. 36.
87. Fenestrapora. Hall and Simpson, Pal. New York, VI, p. xxii.
89. Fenestrapora. Miller, North American Geol. Pal., p. 305.
90. Fenestrapora. Ulrich, Geol. Surv. Illinois, VIII, pp. 395, 557.
95. Fenestrapora. Simpson, Thirteenth Ann. Rep. State Geologist New York for the year 1893, pp. 690, 701, 725; Forty-seventh Ann. Rep. New York State Mus., pp. 884, 895, 919.
96. Fenestrapora. Ulrich, Zittel's Textb. Pal. (Eng. ed.), p. 282.
97. Fenestrapora. Simpson, Fourteenth Ann. Rep. State Geologist New York for the year 1894, pp. 506, 520.

trapora biperforata Hall.

85. Fenestrapora biperforata. Hall, Rep. State Geologist New York for the year 1884, pl. ii, 17.
87. Fenestrapora biperforata. Hall and Simpson, Pal. New York, VI, p. 286, pl. lxvi, 34–39.
97. Fenestrapora biperforata. Simpson, Fourteenth Ann. Rep. State Geologist New York for the year 1894, pl. iii, 7–12.
Hamilton: Moscow, Livingston County, and other localities in central and western New York.

trapora infraporosa (Ulrich).

86. Semicoscinium infraporosa. Ulrich, Contr. American Pal., I, p. 14, pl. i, 6–6*b*.
89. Fenestrapora infraporosa. Miller, North American Geol. Pal., p. 305.
Hamilton: Falls of the Ohio.

strapora largior (Hall) Simpson.

97. Fenestrapora largior Hall. Simpson, Fourteenth Ann. Rep. State Geologist New York for the year 1894, pl. iii, 6. (Not described.)
Geological horizon and locality not given.
Obs. Simpson ascribes this species to Hall, but we have been unable to find it described in any of Hall's works. .

trapora occidentalis Ulrich.

90. Fenestrapora occidentalis. Ulrich, Geol. Surv. Illinois, VIII, p. 558, pl, xliv, 2, 2*a*, pl. liv, 7–7*e*.
Hamilton: Buffalo, Iowa.

strella D'Orbigny. In error for Fenestella.

Fenestrellina D'Orbigny. Not recognized.

1850. Fenestrellina. D'Orbigny, Prod. de Pal., I, p. 153.

1885. Fenestrellina. Hall, Rep. State Geologist New York for the year 1884 p. 36.

Obs. Hall's Fenestrellina (D'Orbigny's?) = Fenestella.

Fistulicella Simpson. See Pinacotrypa Ulrich.

Fistulicella plana Simpson. See Pinacotrypa plana (Hall).

FISTULIPORA McCoy. Genotype: Fistulipora minor McCoy=Calamopora incrustans Phillips.

1850. Fistulipora. McCoy, Ann. Mag. Nat. Hist., ser. 2, III, p. 131.

1851. Fistulipora. Milne-Edwards and Haime, Pol. Foss. Terr. Pal., p. 219.

1854. Fistulipora. McCoy, Brit. Pal. Foss., p. 11.

1854. Fistulipora. McCoy, Contr. Brit. Pal., p. 99.

1860. Fistulipora. Milne-Edwards, Hist. Nat. des Corall., III, p. 238.

1874. Fistulipora. Nicholson, Pal. Province Ontario, p. 63.

1876. Fistulipora. Dybowski, Verh. Mineral. Gesellschaft St. Petersburg, (2) X, p. 180.

1879. Fistulipora. Nicholson, Pal. Tabulate Corals, p. 292.

1881. Fistulipora. Nicholson, Genus Monticulipora, p. 91.

1882. Fistulipora. Ulrich, Jour. Cincinnati Soc. Nat. Hist., V, p. 156.

1884. Fistulipora. Ulrich, Jour. Cincinnati Soc. Nat. Hist., VII, p. 43.

1885. Fistulipora. Nicholson and Foord, Ann. Mag. Nat. Hist., ser. 5, XVI, p. 500.

1886. Fistulipora. Waagen and Wentzel, Pal. Indica, Ser. XIII, pp. 909, 922.

1887. Fistulipora. Hall and Simpson, Pal. New York, VI, p. xviii.

1888. Fistulipora (in part). James and James, Jour. Cincinnati Soc. Nat. Hist., XI, p. 32.

1889. Fistulipora. Miller, North American Geol. Pal., p. 305.

1890. Fistulipora. Ulrich, Geol. Surv. Illinois, VIII, pp. 382, 474.

1896. Fistulipora. J. F. James, Jour. Cincinnati Soc. Nat. Hist., XVIII, p. 119.

1896. Fistulipora. Ulrich, Zittel's Textb. Pal. (Engl. ed.), p. 269; p. 105 (not Ulrich).

1897. Fistulipora. Simpson, Fourteenth Ann. Rep. State Geologist New York for the year 1894, p. 559.

1882. Didymopora. Ulrich, Jour. Cincinnati Soc. Nat. Hist., V, p. 156.

1885. Dybowskia. Waagen and Pichl, Pal. Indica, Ser. XIII, p. 717.

1886. Dybowskiella. Waagen and Wentzel, Pal. Indica, Ser. XIII, pp. 910, 916.

1887. Lichenalia (not Hall, 1852). Hall and Simpson, Pal. New York, VI, p. xvi.

1887. Lichenalia (not Hall, 1852). Foerste, Bull. Sci. Lab. Denison Univ., II, p. 168.

1889. Lichenalia (not Hall, 1852). Miller, North American Geol. Pal., p. 311.

1897. Lichenalia (not Hall, 1852). Simpson, Fourteenth Ann. Rep. State Geologist New York for the year 1894, p. 559.

1899. Lichenalia (not Hall, 1852). Grabau, Bull. Buffalo Soc. Nat. Sci., VI, p. 171.

1897. Fistuliporella. Simpson, Fourteenth Ann. Rep. State Geologist New York for the year 1894, p. 560.

Fistulipora acervulosa Rominger.

1866. Fistulipora acervulosa. Rominger, Proc. Acad. Nat. Sci. Philadelphia, p. 120.

Hamilton: Alpena, Michigan.

lipora alternata (Hall).

83. Lichenalia alternata. Hall, Trans. Albany Institute, X, p. 150 (abstract, 1881, p. 8).

86. Lichenalia alternata. Hall, Rep. State Geologist New York for the year 1885, pl. xxxi, 39–41.

87. Lichenalia alternata. Hall and Simpson, Pal. New York, VI, p. 80, pl. xxxi, 39–41.
Hamilton: Falls of the Ohio.

lipora asteria (Prout).

59. Coscinium asterias. Prout, Trans. St. Louis Acad. Sci., I, p. 574.

66. Coscinium asterias. Prout, Geol. Surv. Illinois, II, p. 416, pl. xxii, 7, 7*a*.
Keokuk: Near Warsaw, Illinois.

lipora astrica Ulrich.

90. Fistulipora astrica. Ulrich, Geol. Surv. Illinois, VIII, p. 477, fig. 8*a* (p. 320), pl. xlvii, 5–5*b*, pl. xlviii, 3.

89. Fistulipora astricta (in error for astrica), Ulrich (in press). Miller, North American Geol. Pal., fig. 476 (p. 305).

96. Fistulipora astrica. Ulrich, Zittel's Textb. Pal. (Engl. ed.), fig. 442 (p. 269).
Hamilton: Buffalo, Iowa.

lipora astricta (Ulrich) Miller. See Fistulipora astrica Ulrich.

lipora ? bullata (Hall and Simpson).

87. Lichenalia bullata. Hall and Simpson, Pal. New York, VI, p. 205, pl. lvii, 12, 13.
Hamilton: Near Le Roy, New York.
Obs. This form may be a Pinacotrypa.

lipora Canadensis Billings. Coral belonging to the genus vosites.

lipora carbonaria Ulrich.

84. Fistulipora carbonaria. Ulrich, Jour. Cincinnati Soc. Nat. Hist., VII, p. 45, pl. iii, 1, 1*a*.

94. Fistulipora carbonaria. Keyes, Missouri Geol. Surv., V, p. 16.
Upper Coal Measures: Kansas City, Missouri; Manhattan, Kansas.

lipora? clausa Ulrich. See Meekopora clausa (Ulrich).

lipora colliculata (Hall).

83. Lichenalia colliculata. Hall, Trans. Albany Institute, X, p. 184 (abstract, 1881, p. 184).

84. Lichenalia colliculata. Hall, Rep. State Geologist New York for the year 1883, p. 36.

87. Lichenalia colliculata. Hall and Simpson, Pal. New York, VI, p. 200.

97. Lichenalia colliculata. Simpson, Fourteenth Ann. Rep. State Geologist New York for the year 1894, pl. xxii, 8, 9.
Hamilton: York, New York.

lipora collina Ulrich. See Cyclotrypa collina (Ulrich).

lipora communis Ulrich. See Cyclotrypa communis (Ulrich).

lipora compressa Rominger.

66. Fistulipora compressa. Rominger, Proc. Acad. Nat. Sci. Philadelphia, p. 123.

94. Fistulipora compressa. Keyes, Missouri Geol. Surv., V, p. 16.
Keokuk: Lagrange, Missouri.

Fistulipora confertipora Hall and Simpson. See Lioclema confertiporum (Hall).

Fistulipora ? confusa (Hall and Simpson).

1887. Lichenalia confusa. Hall and Simpson, Pal. New York, VI, p. 204.
Hamilton: Near Le Roy, New York.

Fistulipora ? constricta (Hall).

1883. Lichenalia constricta. Hall, Trans. Albany Institute, X, p. 183 (abstract, 1881, p. 183).
1884. Lichenalia constricta. Hall, Rep. State Geologist New York for the year 1883, p. 36.
1887. Fistulipora constricta. Hall and Simpson, Pal. New York, VI, p. 227.
1888. Fistulipora constricta. Hall, Seventh Ann. Rep. State Geologist New York for the year 1887, pl. xv, 11, 12; Forty-first Ann. Rep. New York State Mus., pl. xv, 11, 12.
1897. Fistuliporella constricta. Simpson, Fourteenth Ann. Rep. State Geologist New York for the year 1894, pl. xxii, 5–7.
Hamilton: Near Le Roy and York, New York.
Obs.—This species is the type of Simpson's Fistuliporella. This genus, in the present state of our knowledge, is a synonym of Fistulipora. However, when this species is better known, the genus Fistuliporella may stand.

Fistulipora conulata (Hall).

1883. Lichenalia conulata. Hall, Trans. Albany Institute, X, p. 151 (abstract, 1881, p. 9).
1886. Lichenalia conulata. Hall, Rep. State Geologist New York for the year 1885, pl. xxxi, 10–14.
1887. Lichenalia conulata. Hall and Simpson, Pal. New York, VI, p. 81, pl. xxxi, 10–14.
Hamilton: Falls of the Ohio.

Fistulipora cornuta (Hall and Simpson).

1887. Lichenalia cornuta. Hall and Simpson, Pal. New York, VI, p. 203.
1888. Lichenalia cornuta. Hall, Seventh Ann. Rep. State Geologist New York for the year 1887, pl. xv, 6; Forty-first Ann. Rep. New York State Mus., pl. xv, 6.
Hamilton: Near York and near Le Roy, New York.

Fistulipora (? Dichotrypa) corrugata Ulrich.

1890. Fistulipora (? Dichotrypa) corrugata. Ulrich, Geol. Surv. Illinois, VIII, p. 480, pl. xlvii, 8, *8a*, pl. xlviii, 6–*6b*.
Hamilton: Thunder Bay, Michigan.

Fistulipora ? crassa (Hall).

1879. Trematopora crassa. Hall, Thirty-second Ann. Rep. New York State Mus., p. 152 (reprint, 1880, p. 14).
1883. Trematopora crassa. Hall, Rep. State Geologist New York for the year 1882, pl. xi, 21, 22.
1887. Lichenalia crassa. Hall and Simpson, Pal. New York, VI, p. 30, pl. xi, 21, 22.
Lower Helderberg: Schoharie, New York.

Fistulipora crassa Rominger (not Hall nor Lonsdale). See Fistulipora romingeri Nicholson and Foord.

Fistulipora confertipora Hall and Simpson. See Lioclema confertiporum (Hall).

lipora cultellata (Hall).

884. Lichenalia cultellata. Hall, Rep. State Geologist New York for the year 1883, p. 35.

887. Lichenalia cultellata. Hall and Simpson, Pal. New York, VI, p. 202, pl. lxiv, 1, 2.

Hamilton: Fall Brook and York, New York.

ulipora decipiens Hall and Simpson. See Lioclema decipiens all).

ulipora densa Hall and Simpson. See Lioclema densum (Hall).

ulipora digitata Hall and Simpson. See Lioclema digitatum (Hall).

lipora distans (Hall).

879. Lichenalia distans. Hall, Thirty-second Ann. Rep. New York State Mus., p. 157 (reprint, 1880, p. 19).

883. Lichenalia distans. Hall, Rep. State Geologist New York for the year 1882, pl. xv, 8, 9.

887. Lichenalia distans. Hall and Simpson, Pal. New York, VI, p. 32, pl. xv, 8, 9.

Lower Helderberg: Schoharie, New York.

lipora distensa (Hall).

887. Lichenalia distans. Hall and Simpson, Pal. New York, VI, p. 197.

888. Lichenalia distensa. Hall, Seventh Ann. Rep. State Geologist New York for the year 1887, pl. xv, 5; Forty-first Ann. Rep. New York State Mus., pl. xv, 5.

Hamilton: Western New York.

ulipora elegans Rominger. See Pinacotrypa elegans (Rominger).

lipora eriensis Rominger.

866. Fistulipora Eriensis. Rominger, Proc. Acad. Nat. Sci. Philadelphia, p. 121.

885. Fistulipora eriensis. Nicholson and Foord, Ann. Mag. Nat. Hist., ser. 5, XVI, p. 511, pl. xvii, 4, 4*a*.

Hamilton: Hamburg, New York.

lipora excellens Ulrich.

884. Fistulipora excelens. Ulrich, Jour. Cincinnati Soc. Nat. Hist., VII, p. 46, pl. iii, 3–3*b*.

Chester: Sloans Valley and Litchfield, Kentucky.

ulipora flabellata Ulrich. See Chiloporella nicholsoni (James).

ulipora flabellum Rominger. See Dichotrypa flabellum (Romger).

lipora foliacea (Hall).

883. Lichenalia foliacea. Hall, Trans. Albany Institute, X, p. 183 (abstract, 1881, p. 183).

884. Lichenalia foliacea. Hall, Rep. State Geologist New York for the year 1883, p. 35.

887. Ceramopora ? (Lichenalia) foliacea. Hall and Simpson, Pal. New York, VI, p. 235, pl. lviii, 6, 7.

Hamilton: West Bloomfield, New York.

lipora foordi Ulrich.

890. Fistulipora foordi. Ulrich, Geol. Surv. Illinois, VIII, p. 479, fig. 5*f* (p. 315), pl. xlvii, 7, 7*a*, pl. xlviii, 4, 4*a*.

889. Fistulipora foordi. (Ulrich in press), Miller, North American Geol. Pal., fig. 477 (p. 305).

Hamilton: Rockford, Iowa.

Fistulipora geometrica (Hall).

1886. Lichenalia geometrica. Hall, Rep. State Geologist New York for the year 1885, pl. xxxii, 21–23.
1887. Lichenalia geometrica. Hall and Simpson, Pal. New York, VI, p. 79, pl. xxxii, 21–23.
1897. Pileotrypa geometrica. Simpson, Fourteenth Ann. Rep. State Geologist New York for the year 1894, pl. xxiii, 15.
Hamilton: Falls of the Ohio.
Obs. This form may be the young of Fistulipora normalis (Hall).

Fistulipora granifera (Hall).

1883. Lichenalia granifera. Hall, Trans. Albany Institute, X, p. 153 (abstract, 1881, p. 11).
1886. Lichenalia (Pileotrypa) granifera. Hall, Rep. State Geologist New York for the year 1885, pl. xxx, 28–31.
1887. Lichenalia (Pileotrypa) granifera. Hall and Simpson, Pal. New York, VI, p. 84, pl. xxx, 28–31.
1897. Pileotrypa granifera. Simpson, Fourteenth Ann. Rep. State Geologist New York for the year 1894, pl. xxiii, 13.
Hamilton: Falls of the Ohio.

Fistulipora halli Rominger.

1866. Fistulipora Halli. Rominger, Proc. Acad. Nat. Sci. Philadelphia, p. 119.
1876. Lichenalia concentrica var. parvula. Hall, Twenty-eighth Ann. Rep. New York State Mus. (documentary edition), pl. vii, 1, 2; ibid. (Museum edition, 1879), p. 117, pl. vii, 1, 2.
1882. Lichenalia concentrica var. parvula. Hall, Eleventh Ann. Rep. Indiana Geol. Nat. Hist., p. 241, pl. vi. 1, 2.
Niagara: Waldron, Indiana.

Fistulipora ?? helios Rominger.

1866. Fistulipora helios. Rominger, Proc. Acad. Nat. Sci. Philadelphia, p. 120.
Upper Helderberg: From the drift of Michigan.
Obs. Compare with Botryllopora socialis Nicholson, with which this form is perhaps identical.

Fistulipora hemispherica (Roemer).

1860. Thecostegites hemisphericus. Roemer, Sil. Fauna West. Tennessee, p. 25, pl. ii, 3, 3*a*.
1889. Thecostegites hemisphericus. Miller, North American Geol. Pal., fig. 228 (p. 207).
Niagara: Perry and Wayne counties, Tennessee.

Fistulipora ? hemispherica (Hall).

1883. Callopora hemispherica. Hall, Trans. Albany Institute, X, p. 183 (abstract, 1881, p. 183).
1884. Callopora hemispherica. Hall, Rep. State Geologist New York for the year 1883, p. 17.
1887. Fistulipora hemispherica. Hall and Simpson, Pal. New York, VI, p. 226, pl. lvii, 8–11.
Hamilton: York, New York.
Obs. This species will probably be found to belong to another genus (Pinacotrypa ?), and hence will not need renaming.

Fistulipora huronensis (Nicholson).

1875. Ceramopora Huronensis. Nicholson, Geol. Mag., new ser., II, p. 37, pl. ii, 5, 5*a*.

lipora huronensis (Nicholson)—Continued.

375. Ceramopora Huronensis. Nicholson, Pal. Province Ontario, p. 78, pl. ii, 5, 5*a*.

391. Ceramopora Huronensis. Whiteaves, Contr. Canadian Pal., I, p. 214.

Hamilton: Arkona, Ontario; Hay River, Canada (Whiteaves).

Obs. Lichenalia (Ceramopora) clypeiformis Hall may be a synonym of this species.

lipora incrassata (Nicholson).

374. Callopora incrassata. Nicholson, Geol. Mag., new ser., I; p. 13, pl. ii, 1.

374. Callopora incrassata. Nicholson, Pal. Province Ontario, p. 61, fig. 19*a–d*.

379. Fistulipora incrassata. Nicholson, Pal. Tabulate Corals, p. 308, fig. 40, pl. xv, 3–3*b*.

Hamilton: Widder and Arkona, Ontario.

lipora interaspera Hall and Simpson.

387. Fistulipora interaspera. Hall and Simpson, Pal. New York, VI, p. 218.

397. Lichenalia interaspera. Simpson, Fourteenth Ann. Rep. State Geologist New York, for the year 1894, pl. xxii, 10.

Hamilton: Lake Canandaigua, New York.

lipora intercellata Hall and Simpson. See Lioclema intercellatum all).

lipora involvens Hall and Simpson. See Lioclema involvens all and Simpson).

lipora labiosa Winchell.

66. Fistulipora labiosa. Winchell, Rep. Lower Penin. Michigan, p. 88.

Hamilton: Petoskey, Michigan.

lipora ? lamellata (Hall).

83. Thallostigma lamellata. Hall, Trans. Albany Institute, X, p. 155 (abstract, 1881, p. 13).

86. Fistulipora lamellata. Hall, Fifth Ann. Rep. State Geologist New York for the year 1885, pl. xxx, 21–23.

87. Fistulipora lamellata. Hall and Simpson, Pal. New York, VI, p. 87, pl. xxx, 21–23.

Upper Helderberg: Onondaga Valley, New York.

lipora ? laxata Ulrich. See Bythotrypa laxata (Ulrich).

lipora lens Whitfield. See Calloporella ? lens (Whitfield).

lipora longimacula (Hall).

83. Thallostigma longimacula. Hall, Trans. Albany Institute, X, p. 185 (abstract, 1881, p. 185).

84. Thallostigma longimacula. Hall, Rep. State Geologist New York for the year 1883, p. 23.

87. Fistulipora longimacula. Hall and Simpson, Pal. New York, VI, p. 209.

Hamilton: York, New York.

Obs. This may be the same as Fistulipora sulcata Rominger.

lipora lunata Rominger. See Buskopora lunata (Rominger).

lipora maculosa (Hall).

74. Trematopora maculosa. Hall, Twenty-sixth Ann. Rep. New York State Mus., p. 106.

79. Callopora maculosa. Hall, Thirty-second Ann. Rep. New York State Mus., p. 156 (reprint, 1880, p. 18).

Fistulipora maculosa (Hall)—Continued.

1883. Callopora maculosa. Hall, Rep. State Geologist New
1882, pl. xiv, 1–8.

1887. Lichenalia maculosa. Hall and Simpson, Pal. New Y
xiv, 1–8.

1874. Trematopora ponderosa. Hall, Twenty-sixth Ann. Rep
Mus., p. 106.

Lower Helderberg: Catskill Creek and Clarksville, New

Fistulipora micropora Hall and Simpson. See Lioclem
(Hall).

Fistulipora minuta Rominger. See Lioclema minutum

Fistulipora monticulata Ulrich.

1890. Fistulipora monticulata. Ulrich, Geol. Surv. Illinois, VII
3–3*b*, pl. xlviii, 2, 2*a*.

Hamilton: Buffalo, Iowa.

Fistulipora multaculeata Hall and Simpson. See Lioc
leatum (Hall).

Fistulipora ? multipora James. See Chiloporella nicho

Fistulipora neglecta Rominger.

1866. Fistulipora neglecta. Rominger, Proc. Acad. Nat. Sci. Phi

1876. Lichenalia concentrica. Hall, Twenty-eighth Ann. Rep.
Mus. (documentary edition), pl. v, 9–16, pl. vi, 1, 2, 4,
ibid. (Museum edition, 1879), p. 116, pl. v, 9–16, pl. vi,
3–11.

1881. Lichenalia concentrica. Quenstedt, Roehren- und Stern
cxlvi, 71, 72.

1882. Lichenalia concentrica. Hall, Eleventh Ann. Rep. Indian
p. 240, pl. iv, 9–16, pl. v, 1, 2, 4, 7–10, pl. vi, 3–11.

1884. Lichenalia concentrica. Ulrich, Jour. Cincinnati Soc.
iii, 5.

1887. Lichenalia concentrica. Foerste, Bull. Sci. Lab. Deniso
pl. xvii, 10.

Niagara: Waldron, Indiana.

Fistulipora neglecta-maculata (Hall).

1876. Lichenalia concentrica var. maculata. Hall, Twenty-eigh
York State Mus. (documentary edition), pl. vi, 3, 5,
edition, 1879), p. 117, pl. vi, 3, 5, 6.

1882. Lichenalia concentrica var. maculata. Hall, Eleventh
Geol. Nat. Hist., p. 241, pl. v, 3, 5, 6.

Niagara: Waldron, Indiana.

Fistulipora nodulifera Meek.

1872. Fistulipora nodulifera. Meek, Pal. Eastern Nebraska, p.

1894. Fistulipora nodulifera. Keyes, Missouri Geol. Surv., V, p

1896. Fistulipora nodulifera. Smith, Proc. American Phil. Soc.,

Coal Measures: Nebraska City and other localities in
Mountain, Indian Territory (Smith).

Fistulipora normalis Ulrich.

1886. Fistulipora normalis. Ulrich, Contr. American Pal., I, p.

Hamilton: Falls of the Ohio.

Obs. See also Fistulipora geometrica (Hall) and Fist
(Hall).

ulipora occidens Hall and Whitfield. See Lioclema occidens (Hall id Whitfield).

ulipora operculata Simpson. See Pinacotrypa operculata (Hall id Simpson).

ulipora ovata (Hall).

886. Lichenalia ovata. Hall, Fifth Ann. Rep. State Geologist New York for the year 1885, pl. xxxii, 1–5.

887. Lichenalia ovata. Hall and Simpson, Pal. New York, VI, p. 80, pl. xxxii, 1–5.

897. Lichenalia ovata. Simpson, Fourteenth Ann. Rep. State Geologist New York for the year 1894, pl. xxiii, 2.

Hamilton: Falls of the Ohio.

Obs. See also Fistulipora substellata (Hall).

ulipora oweni James. See Cœloclema oweni (James).

ulipora parasitica Hall and Simpson. See Lioclema parasiticum Iall).

ulipora peculiaris Rominger. See Actinotrypa peculiaris (Rominger).

ulipora ? permarginata (Hall).

883. Lichenalia permarginata. Hall, Trans. Albany Institute, X, p. 151 (abstract, 1881, p. 10).

883. Lichenalia permarginata. Hall, Rep. State Geologist New York for the year 1882, pl. (26) xxiv, 20.

887. Lichenalia permarginata. Hall and Simpson, Pal. New York, VI, p. 82, pl. xxvi, 20.

Upper Helderberg: Onondaga Valley, New York.

ulipora plana Hall and Simpson. See Pinacotrypa plana (Hall).

ulipora ponderosa Hall and Simpson. See Lioclema ponderosum Iall).

ulipora prolifica Ulrich.

884. Fistulipora prolifica. Ulrich, Jour. Cincinnati Soc. Nat. Hist., VII, p. 45, pl. iii, 2, 2*a*.

St. Louis: Colesburg, Kentucky.

ulipora proporoides Nicholson. See Pinacotrypa elegans (Rominger).

ulipora ? pustulosa (Hall and Simpson).

887. Lichenalia pustulosa. Hall and Simpson, Pal. New York, VI, p. 206.

897. Fistulipora pustulosa. Simpson, Fourteenth Ann. Rep. State Geologist New York for the year 1894, pl. xxii, 12.

Hamilton: York, New York.

Obs. This form may be a Pinacotrypa.

ulipora ramosa (Hall and Simpson).

887. Lichenalia ramosa. Hall and Simpson, Pal. New York, VI, p. 199.

898. Lichenalia ramosa. Whiteaves, Contr. Canadian Pal., I, p. 381.

Hamilton: West Williams, Ontario.

ulipora romingeri Nicholson and Foord.

866. Fistulipora crassa. Rominger, Proc. Acad. Nat. Sci. Philadelphia, p. 121.

Fistulipora romingeri Nicholson and Foord—Continued

1885. Fistulipora Romingeri. Nicholson and Foord, Ann. M
5, XVI, p. 506. (Proposed for F. crassa Rominge
having been previously used by Lonsdale for a speci

1898. Fistulipora Romingeri. Whiteaves, Contr. Canadian
Hamilton: Widder, Ontario; Buffalo, Iowa.

Fistulipora rugosa Whitfield. See Batostoma? rugos

Fistulipora saffordi Winchell.

1866. Fistulipora Saffordi. Winchell, Rep. Lower Penin. M
Hamilton: Petoskey, Michigan.

Fistulipora ? scrobiculata (Hall).

1883. Thallostigma scrobiculata. Hall, Trans. Albany In
(abstract, 1881, p. 185).

1884. Thallostigma scrobiculata. Hall, Rep. State Geologist
year 1883, p. 20.

1887. Fistulipora scrobiculata. Hall and Simpson, Pal. Ne
pl. lviii, 17, 18.

1899. Fistuliporina scrobiculata. Grabau, Bull. Buffalo So
168, fig. 61.
Hamilton: Eighteen-Mile Creek, Erie County and Bel
New York.
Obs. This form may be a Pinacotrypa.

Fistulipora segregata Hall and Simpson. See Liocl
(Hall).

Fistulipora serialis (Hall and Simpson).

1879. Lichenalia torta (in part). Hall, Thirty-second An
State Mus., p. 157 (reprint, 1880, p. 19).

1883. Lichenalia torta. Hall, Rep. State Geologist New Yor
pl. xv, 6.

1883. Lichenalia tortuosa. Hall, Rep. State Geologist New
1882, pl. xiii, 17, 18.

1887. Lichenalia serialis. Hall and Simpson, Pal. New Yor
17, 18, pl. xv, 6.
Lower Helderberg: Clarksville, New York.

Fistulipora serrulata Hall and Simpson. See Pinac
(Hall).

Fistulipora siluriana James. See Chiloporella nichol

Fistulipora solidissima Whitfield. See Lioclemella so
field).

Fistulipora spergenensis Rominger.

1866. Fistulipora Spergenensis. Rominger, Proc. Acad. Nat
p. 122.
Warsaw: Spergen Hill, Indiana.

Fistulipora spheroidea Hall and Simpson. See Lioclе
(Hall).

Fistulipora spinulifera Rominger.

1866. Fistulipora spinulifera. Rominger, Proc. Acad. Nat
p. 121.

1890. Fistulipora spinulifera. Ulrich, Geol. Surv. Illinois,
xlvi, 3–3*d*.
Hamilton: Alpena, Michigan.

lipora stellifera Rominger. See Meekopora stellifera (Rominger).

lipora subcava (Hall).

383. Lichenalia subcava. Hall, Trans. Albany Institute, X, p. 150 (abstract, 1881, p. 8).

383. Lichenalia subcava. Hall, Rep. State Geologist New York for the year 1882, pl. (26) xxiv, 23–25.

387. Lichenalia subcava. Hall and Simpson, Pal. New York, VI, p. 81, pl. xxvi, 23–25.

Hamilton: Falls of the Ohio.

lipora substellata (Hall).

383. Lichenalia substellata. Hall, Trans. Albany Institute, X, p. 149 (abstract, 1881, p. 7).

383. Lichenalia substellata. Hall, Rep. State Geologist New York for the year 1882, pl. (26) xxiv, 26.

386. Lichenalia substellata. Hall, Fifth Ann. Rep. State Geologist New York for the year 1885, pl. xxx, 1–11.

387. Lichenalia substellata. Hall and Simpson, Pal. New York, VI, p. 78, pl. xxvi, 26, pl. xxx, 1–11.

397. Lichenalia substellata. Simpson, Fourteenth Ann. Rep. State Geologist New York for the year 1894, pl. xxiii, 1.

Hamilton: Falls of the Ohio.

Obs. Fistulipora normalis Ulrich and Fistulipora ovata (Hall) may be synonyms of this species.

lipora ? subtilis Hall and Simpson. See Lioclema subtile (Hall).

lipora subtrigona (Hall and Simpson).

387. Lichenalia subtrigona. Hall and Simpson, Pal. New York, VI, p. 196.

388. Lichenalia subtrigona. Hall, Seventh Ann. Rep. State Geologist New York for the year 1887, pl. xv, 3, 4; Forty-first Ann. Rep. New York State Mus., pl. xv, 3, 4.

397. Lichenalia subtrigona. Simpson, Fourteenth Ann. Rep. State Geologist New York for the year 1894, pl. xxiii, 4.

398. Lichenalia subtrigona. Whiteaves, Contr. Canadian Pal., I, p. 381.

Hamilton: West Williams, Ontario.

lipora sulcata Rominger.

366. Fistulipora sulcatus. Rominger, Proc. Acad. Nat. Sci. Philadelphia, p. 120.

Hamilton: Near Alpena, Michigan.

Obs. See also Fistulipora longimacula (Hall).

lipora torta (Hall).

379. Lichenalia torta. Hall, Thirty-second Ann. Rep. New York State Mus., p. 157 (reprint, 1880, p. 19).

383. Lichenalia torta. Hall, Rep. State Geologist New York for the year 1882, pl. xv, 1–5, 7.

387. Lichenalia torta. Hall and Simpson, Pal. New York, VI, p. 31, pl. xv, 1–5, 7.

Lower Helderberg: Clarksville and Schoharie, New York.

lipora ? triangularis (Hall).

383. Thallostigma triangularis. Hall, Trans. Albany Institute, X, p. 187 (abstract, 1881, p. 187).

384. Thallostigma triangularis. Hall, Rep. State Geologist New York for the year 1883, p. 32.

Fistulipora ? triangularis (Hall)—Continued.

1887. Fistulipora triangularis. Hall and Simpson, Pal. New York, VI, p. 222.
Hamilton: Western New York.

Fistulipora ? trifaria Hall and Simpson.

1887. Fistulipora trifaria. Hall and Simpson, Pal. New York, VI, p. 222.
Hamilton: Fall brook, New York.

Fistulipora trifolia Rominger. See Phractopora trifolia (Rominger).

Fistulipora ? triloba Hall and Simpson.

1887. Fistulipora triloba. Hall and Simpson, Pal. New York, VI, p. 29.
1888. Fistulipora triloba. Hall, Seventh Ann. Rep. State Geologist New York for the year 1887, pl. xv, 1, 2; Forty-first Ann. Rep. New York State Mus., pl. xv, 1, 2.
1897. Fistulipora triloba. Simpson, Fourteenth Ann. Rep. State Geologist New York for the year 1894, pl. xxii, 11.
Lower Helderberg: Near Schoharie, New York.

Fistulipora ? tuberculata (Prout).

1859. Coscinium tuberculatum. Prout, Trans. St. Louis Acad. Sci., I, p. 573.
1866. Coscinium tuberculatum. Prout, Geol. Surv. Illinois, II, p. 415, pl. xxii, 6.
Keokuk: Near Warsaw, Illinois.

Fistulipora ? umbilicata (Hall).

1883. Thallostigma umbilicata. Hall, Trans. Albany Institute, X, p. 185 (abstract, 1881, p. 185).
1884. Thallostigma umbilicata. Hall, Rep. State Geologist New York for the year 1883, p. 22.
1887. Fistulipora umbilicata. Hall and Simpson, Pal. New York, VI, p. 213.
Hamilton: York, New York.
Obs. This may prove to be a species of Pinacotrypa.

Fistulipora ? unilinea Hall and Simpson.

1887. Fistulipora unilinea. Hall and Simpson, Pal. New York, VI, p. 217, pl. lvii, 1, 2, 5.
Hamilton: York, New York.
Obs. This may prove to be a species of Pinacotrypa.

Fistulipora utriculus Rominger.

1866. Fistulipora utriculus. Rominger, Proc. Acad. Nat. Sci. Philadelphia, p. 121.
1885. Fistulipora utriculus. Nicholson and Foord, Ann. Mag. Nat. Hist., ser. 5, XVI, p. 508, pl. xvi, 1–1*e*, pl. xvii, 1, 1*a*.
1898. Fistulipora utriculus. Whiteaves, Contr. Canadian Pal., I, p. 380.
Hamilton: Widder and Arkona, Ontario.

Fistulipora variapora Hall. See Pinacotrypa variapora (Hall).

Fistulipora vesiculata (Hall and Simpson).

1887. Lichenalia vesiculata. Hall and Simpson, Pal. New York, VI, p. 198, pl. lvii, 14–19, pl. lix, 1, 14.
1897. Lichenalia vesiculata. Simpson, Fourteenth Ann. Rep. State Geologist New York for the year 1894, pl. xxiii, 3.
Hamilton: Canandaigua Lake, York and near Le Roy, New York.

Fistuliporella Simpson. See Fistulipora McCoy, and observation on Fistulipora ? constricta (Hall).

lliporella constricta Simpson. See Fistulipora ? constricta (Hall).

lliporidra Simpson. See Favicella Hall and Simpson.

lliporidra tessellata Simpson. See Favicella tessellata (Hall and npson).

lliporina Simpson. See Pinacotrypa Ulrich.

lliporina confertipora Simpson. See Lioclema confertiporum all).

lliporina digitata Simpson. See Lioclema digitatum (Hall).

lliporina micropora Simpson. See Lioclema microporum (Hall).

lliporina minuta Grabau. See Lioclema minutum (Rominger).

lliporina multiculeata Simpson. See Lioclema multaculeatum all).

lliporina ponderosa Simpson. See Lioclema ponderosum (Hall).

lliporina scrobiculata Grabau. See Fistulipora ? scrobiculata all).

lliporina segregata Grabau. See Lioclema segregatum (Hall).

lliporina serrulata Simpson. See Pinacotrypa serrulata (Hall).

lliporina stellata Simpson. See Pinacotrypa stellata (Hall).

lliporina variopora Simpson. See Pinacotrypa variapora (Hall).

elliporella Simpson. See Polypora McCoy.

elliporina Simpson. See Fenestella Lonsdale.

tra Linnæus. Not Paleozoic.

tra carbaseoides Eaton. Not recognized.

332. Flustra carbaseoides. Eaton, Geol. Textb., ed. 2, p. 44.
Devonian: Glenns Falls.

tra spatulata Prout. See Worthenopora spatulata (Prout).

tra tuberculata Prout. See Stenopora tuberculata (Prout).

itzella Waagen and Wentzel. See Batostomella Ulrich.

conome of authors. See Pinnatopora Vine.

conome carinata Hall. See Pinnatopora carinata (Hall).

conome nereidis White. See Pinnatopora nereidis (White).

conome nodata Hall. See Pinnatopora nodata (Hall).

conome sinuosa Hall. See Pinnatopora sinuosa (Hall).

conome tenuistriata Hall. See Pinnatopora tenuistriata (Hall).

conome trilineata Meek. See Pinnatopora trilineata (Meek).

conome whitii Foerste. See Pinnatopora whitii (Foerste).

SOTRYPA Hall. Genotype: Lichenalia paliformis Hall.

386. Glossotrypa. Hall, Fifth Ann. Rep. State Geologist New York for the year 1885, expl. pl. xxxi, 15–18.

387. Glossotrypa. Hall and Simpson, Pal. New York, VI, p. xvii.

389. Glossotrypa. Miller, North American Geol. Pal., p. 307.

397. Glossotrypa. Simpson, Fourteenth Ann. Rep. State Geologist New York for the year 1894, p. 562.

Obs. If the lunarium is frequently repeated (interrupted) as a diaphragm, as described, the genus is distinct. This character is so extraordinary that we think it is due to faulty observation or peculiar preservation. If so, the name is a synonym for Buskopora Ulrich.

Glossotrypa paliformis (Hall).

1883. Lichenalia paliformis. Hall, Trans. Albany Institute, X, p. 152 (abstract, 1881, p. 11).
1886. Lichenalia (Glossotrypa) paliformis. Hall, Fifth Ann. Rep. State Geologist New York for the year 1885, pl. xxxi, 15–18.
1887. Lichenalia (Glossotrypa) paliformis. Hall and Simpson, Pal. New York, VI, p. 85, pl. xxxi, 15–18.
1897. Glossotrypa paliformis. Simpson, Fourteenth Ann. Rep. State Geologist New York for the year 1894, pl. xxiv, 8–10.
Hamilton: Falls of the Ohio.

GLYPTOPORA Ulrich. Genotype: Coscinium plumosum Prout.

1884. Glyptopora. Ulrich, Jour. Cincinnati Soc. Nat. Hist., VII, p. 39.
1890. Glyptopora. Ulrich, Geol. Surv. Illinois, VIII, pp. 387, 511.
1896. Glyptopora. Ulrich, Zittel's Textb. Pal. (Engl. ed.), p. 280.

Glyptopora elegans (Prout).

1860. Coscinium elegans. Prout, Trans. St. Louis Acad. Sci., I, p. 572.
1866. Coscinium elegans. Prout, Geol. Surv. Illinois, II, p. 413, pl. xxii, 2, 2*a*.
1884. Glyptopora elegans. Ulrich, Jour. Cincinnati Soc. Nat. Hist., VII, p. 40.
1890. Glyptopora elegans. Geol. Surv. Illinois, VIII, p. 518, pl. lxxviii, 10–10*e*.
1894. Glyptopora elegans. Keyes, Missouri Geol. Surv., V, p. 21.
Warsaw: Warsaw and Nauvoo, Illinois; Curryville, Missouri.

Glyptopora keyserlingi (Prout).

1858. Coscinium Keyserlingi. Prout, Trans. St. Louis Acad. Sci., I, p. 269, pl. xv, 4, 4*a*.
1884. Glyptopora keyserlingi. Ulrich, Jour. Cincinnati Soc. Nat. Hist., VII, p. 40.
1890. Glyptopora keyserlingi. Ulrich, Geol. Surv. Illinois, VIII, p. 517, pl. lxxviii, 4–4*b*.
1894. Glyptopora keyserlingi. Keyes, Missouri Geol. Surv., V, p. 22.
1860. Coscinium wortheni. Prout, Trans. St. Louis Acad. Sci., I, p. 571.
1866. Coscinium wortheni. Prout, Geol. Surv. Illinois, II, p. 412, pl. xxii, 1, 1*a*.
Keokuk: Warsaw, Illinois.

Glyptopora megastoma Ulrich. See Phractopora megastoma (Ulrich).

Glyptopora michelinia (Prout).

1860. Coscinium Michelinia. Prout, Trans. St. Louis Acad. Sci., I, p. 573.
1866. Coscinium Michelinia. Prout, Geol. Surv. Illinois, II, p. 414, pl. xxii, 4, 4*a*.
1884. Glyptopora michelinia. Ulrich, Jour. Cincinnati Soc. Nat. Hist., VII, p. 40.
1890. Glyptopora michelinia. Ulrich, Geol. Surv. Illinois, VIII, p. 515, pl. lxxviii, 8–8*b*.
1894. Glyptopora michelinia. Keyes, Missouri Geol. Surv., V, p. 22.
1897. Phractopora sagenella (not of Prout). Simpson, Fourteenth Ann. Rep. State Geologist, New York, for the year 1894, fig. 95 (p. 539).
Warsaw: Warsaw, Illinois; Barretts Station, Missouri.

Glyptopora pinnata Ulrich. See Phractopora pinnata (Ulrich).

Glyptopora plumosa (Prout).

1860. Coscinium plumosum. Prout, Trans. St. Louis Acad. Sci., I, p. 572.
1866. Coscinium plumosum. Prout, Geol. Surv. Illinois, II, p. 414, pl. xxii, 3, 3*b*.
1884. Glyptopora plumosa. Ulrich, Jour. Cincinnati Soc. Nat. Hist., VII, p. 40.

yptopora plumosa (Prout)—Continued.

1890. Glyptopora plumosa. Ulrich, Geol. Surv. Illinois, VIII, p. 512, pl. lxxviii, 3–3*c*.

1894. Glyptopora plumosa. Keyes, Missouri Geol. Surv., V, p. 20, pl. xxxiii, 5.
Warsaw: Warsaw, Illinois; Barretts Station, Missouri.

yptopora punctipora Ulrich.

1890. Glyptopora punctipora. Ulrich, Geol. Surv. Illinois, VIII, p. 519, pl. lxxviii, 9, 9*a*.
Chester: Monroe County, Illinois; Livingston and Meade counties, Kentucky.

yptopora sagenella (Prout).

1860. Coscinium saganella. Prout, Trans. St. Louis Acad. Sci., I, p. 573.

1866. Coscinium saganella. Prout, Geol. Surv. Illinois, II, p. 415, pl. xxii, 5, 5*a*.

1884. Glyptopora sagenella. Ulrich, Jour. Cincinnati Soc. Nat. Hist., VII, p. 40.

1890. Glyptopora sagenella. Ulrich, Geol. Surv. Illinois, VIII, p. 513, pl. lxxviii, 6, 6*a*.

1894. Glyptopora sagenella. Keyes, Missouri Geol. Surv., V, p. 21.
Keokuk: Bentonsport, Iowa.
Warsaw: Warsaw, Illinois.

yptopora sagenella-caliculosa Ulrich.

1866. Coscinium plumosum (in part). Prout, Geol. Surv. Illinois, II, p. 415, pl. xxii, 3*a*.

1890. Glyptopora sagenella var. caliculosa. Ulrich, Geol. Surv. Illinois, VIII, p. 514.
Warsaw: Warsaw, Illinois.

yptopora sagenella-lata Ulrich.

1890. Glyptopora sagenella var. lata. Ulrich, Geol. Surv. Illinois, VIII, p. 515, pl. lxxviii, 7.

1897. Phractopora michelini. Simpson, Fourteenth Ann. Rep. State Geologist New York for the year 1894, fig. 96 (p. 539).
Warsaw: Warsaw, Illinois.

yptotrypa Miller, Simpson. Written in error for Glyptopora Jlrich.

NIOCLADIA Etheridge, Jun. Genotype: Carinella cellulifera Etheridge, Jun.

1873. Carinella. Etheridge, Jun., Geol. Mag., X, p. 433.

1876. Goniocladia. Etheridge, Jun., Geol. Mag., Dec. 2, III, p. 522.

1885. Goniocladia. Waagen and Pichl, Pal. Indica, Ser. XIII, pp. 775, 804.

1886. Goniocladia. Ulrich, Contr. American Pal., I, p. 5.
Obs.—No American species referable to this genus has been published.

NIOTRYPA Ulrich. Genotype: Goniotrypa bilateralis Ulrich.

1889. Goniotrypa. Ulrich, Contr. Micro-Pal. Cambro-Sil., Part II, p. 40.

1889. Goniotrypa. Miller, North American Geol. Pal., p. 307.

1890. Goniotrypa. Ulrich, Geol. Surv. Illinois, VIII, p. 389.

1897. Goniotrypa. Simpson, Fourteenth Ann. Rep. State Geologist New York for the year 1894, p. 545.

iiotrypa bilateralis Ulrich.

1889. Goniotrypa bilateralis. Ulrich, Contr. Micro-Pal. Cambro-Sil., Part II, p. 41, figs. 1–3, pl. ix, 1.

1889. Goniotrypa bilateralis. Miller, North American Geol. Pal., fig. 481 (p. 307).

Goniotrypa bilateralis Ulrich—Continued.

1895. Goniotrypa bilateralis. Whiteaves, Pal. Foss, III, p. 118.
Cincinnati (Richmond): Stony Mountain, Manitoba.

Gorgonia Linnæus. Not Paleozoic.

Gorgonia anticorum. Castelnau. Not recognized.

1843. Gorgonia anticorum. Castelnau, Syst. Sil., p. 50, pl. xxiv, 1.
Lake Huron.

Gorgonia? aspera Hall. See Phylloporina aspera (Hall).

Gorgonia infundibuliformis Eaton. Not recognized.

1832. Gorgonia infundibuliformis. Eaton, Geol. Text-book, ed. 2, p. 43.

Gorgonia perantiqua Hall. Not recognizable.

1847. Gorgonia perantiqua. Hall, Pal. New York, I, p. 76, pl. xxvi, 5*a*, *b*.
1850. Enallopora perantiqua. D'Orbigny, Prodr. de Pal., I, p. 22.
1889. Enallopora perantiqua. Miller, North American Geol. Pal., p. 301.
Trenton: Middleville, Herkimer County, New York.

Gorgonia retiformis Hall. Not a bryozoan. See Pal. New York, II, 1852, p. 174.

1843. Gorgonia ? retiformis. Hall, Geol. Rep. Fourth District New York, p. 115, fig. 1.

Gorgonia siluriana Castelnau. Not recognized.

1843. Gorgonia siluriana. Castelnau, Syst. Sil., p. 50.

GRAPTODICTYA Ulrich. Genotype: Ptilodictya perelegans Ulrich.

1882. Graptodictya. Ulrich, Jour. Cincinnati Soc. Nat. Hist., V, pp. 151, 165.
1889. Graptodictya. Miller, North American Geol. Pal., p. 307.
1890. Graptodictya. Ulrich, Geol. Surv. Illinois, VIII, p. 393.
1897. Graptodictya. Simpson, Fourteenth Ann. Rep. New York State Geologist for the year 1894, p. 541.

Graptodictya nitida Ulrich. See Graptodictya perelegans (Ulrich).

Graptodictya perelegans (Ulrich).

1878. Ptilodictya perelegans. Ulrich, Jour. Cincinnati Soc. Nat. Hist., I, p. 94, pl. iv, 16, 16*a*.
1882. Graptodictya perelegans. Ulrich, Jour. Cincinnati Soc. Nat. Hist., V, p. 165.
1882. Graptodictya nitida. Ulrich, Jour. Cincinnati Soc. Nat. Hist., V, p. 166, pl. vii, 8, 8*a*.
Cincinnati (Richmond): Clarksville and other localities in Ohio.

HEDERELLA Hall. Genotype: Alecto? Canadensis Nicholson.

1883. Hederella. Hall, Trans. Albany Institute, X, p. 194 (abstract, 1881, p. 194).
1887. Hederella. Hall and Simpson, Pal. New York, VI, p. xxvi.
1889. Hederella. Miller, North American Geol. Pal., p. 308.
1897. Hederella. Simpson, Fourteenth Ann. Rep. State Geologist New York for the year 1894, p. 599.
1899. Hederella. Grabau, Bull. Buffalo Soc. Nat. Sci., VI, p. 178.
1885. Nicholsonia. Davis, Kentucky Foss. Corals, part 2. (Name proposed but not defined.)

Hederella adnata (Davis).

1885. Nicholsonia adnata. Davis, Kentucky Foss. Corals, part. 2, pl. lxxviii, 19. (Not described.)
Hamilton: Falls of the Ohio.
Obs.—Compare this form with Hederella filiformis (Billings).

ella alternata (Hall and Whitfield).

73. Stomatopora ? alternata. Hall and Whitfield, Twenty-third Ann. Rep. New York State Museum, p. 235, pl. x, 7, 8.

Hamilton: Rockford and Hackberry, Iowa.

Obs.—Whiteaves (Contr. Canadian Pal., I, p. 210) makes this a synonym for Hederella Canadensis (Nicholson).

ella canadensis (Nicholson).

74. Alecto ? Canadensis. Nicholson, Canadian Naturalist, ser. 2, VII, p. 146.

74. Aulopora ? Canadensis. Nicholson, Pal. Province Ontario, p. 124, fig. 57*a–e*.

33. Hederella Canadensis. Hall, Trans. Albany Institute, X, p, 194 (abstract, 1881, p. 194).

34. Hederella Canadensis. Hall, Rep. State Geologist New York for the year 1883, p. 53.

35. Nicholsonia canadensis. Davis, Kentucky Foss. Corals, part 2, pl. li, 6, pl. lxxiii, 10, 11, pl. lxxviii, 18, pl. lxxx, 15.

37. Hederella Canadensis. Hall and Simpson, Pal. New York, VI, p. 277, pl. lxv, 1–8, 14, ? 16.

39. Hederella canadensis. Miller, North American Geol. Pal., fig. 483 (p.308).

91. Hederella Canadensis. Whiteaves, Contr. Canadian Pal., I, p. 210, pl. xxviii, 8, 8*a*.

97. Hederella canadensis. Simpson, Fourteenth Ann. Rep. State Geologist New York for the year 1894, pl. xxv, 12, 13.

99. Hederella canadensis. Grabau, Bull. Buffalo Soc. Nat. Sci., VI, p. 178, fig. 77.

Upper Helderberg: Port Colborne, Ontario.

Hamilton: Near Arkona, Ontario; Livingston and Erie counties, and Eighteenmile Creek, New York, Falls of the Ohio; Hay River and Athabasca River, Canada.

ella cirrhosa Hall.

33. Hederella cirrhosa. Hall, Trans. Albany Institute, X, p. 194 (abstract, 1881, p. 194).

34. Hederella cirrhosa. Hall, Rep. State Geologist New York for the year 1883, p. 53.

37. Hederella cirrhosa. Hall and Simpson, Pal. New York, VI, p. 277, pl. lxv, 12, 13.

97. Hederella cirrhosa. Simpson, Fourteenth Ann. Rep. State Geologist New York for the year 1894, pl. xxv, 10, 11.

98. Hederella cirrhosa. Whiteaves, Contr. Canad. Pal., I, Part V, p. 381.

Hamilton: York and Erie counties, New York; Falls of the Ohio.

ella conferta (Hall).

33. Ptilionella conferta. Hall, Trans. Albany Institute, X, p. 195 (abstract, 1881, p. 195).

34. Ptilionella conferta. Hall, Rep. State Geologist New York for the year 1883, p. 56.

37. Hederella conferta. Hall and Simpson, Pal. New York, VI, p. 279.

91. Hederella conferta. Hall, Tenth Ann. Rep. State Geologist New York for the year 1890, p. 56; Forty-fourth Ann. Rep. New York State Museum, p. 86.

Hamilton: Darien Center, New York.

ella filiformis (Billings).

59. Aulopora filiformis. Billings, Canadian Jour., new ser., IV, p. 119.

74. Aulopora filiformis. Nicholson, Pal. Province Ontario, p. 42, fig. 11*a*, *b*.

Hederella filiformis (Billings)—Continued.

1883. Hederella filiformis. Hall, Trans. Albany Institute, X, p. 194 (abstract, 1881, p. 194).
1884. Hederella filiformis. Hall, Rep. State Geologist New York for the year 1883, p. 54.
1887. Hederella filiformis. Hall and Simpson, Pal. New York, VI, p. 278, pl. lxv, 9–11.
1897. Hederella filiformis. Whiteaves, Contr. Canadian Pal., I, p. 211, pl. xxix, 1.
1899. Hederella filiformis. Grabau, Bull. Buffalo Soc. Nat. Sci., VI, p. 179, fig. 77A.
Hamilton: Arkona, Ontario; Livingston, Ontario, and Erie counties, New York.

Hederella magna Hall.

1883. Hederella magna. Hall, Trans. Albany Institute, X, p. 195 (abstract, 1881, p. 195).
1884. Hederella magna. Hall, Rep. State Geologist New York for the year 1883, p. 55.
1887. Hederella magna. Hall and Simpson, Pal. New York, VI, p. 280, pl. lxv, 15.
1898. Hederella magna. Whiteaves, Contr. Canadian Pal., I, Part V, p. 382.
Hamilton: York, and Erie County, New York.

HELICOPORA Claypole. Genotype: Helicopora latispiralis Claypole.

1881. Helicopora. Claypole, Proc. American Assoc. Adv. Sci., XXX, p. 191.
1883. Helicopora. Claypole, Quar. Jour. Geol. Soc. London, XXXIX, p. 32.
1885. Helicopora. Waagen and Pichl, Pal. Indica, Ser. XIII, p. 774.
1886. Helicopora. Ulrich, Contr. American Pal., I, p. 5.
1889. Helicopora. Miller, North American Geol. Pal., p. 308.
1890. Helicopora. Ulrich, Geol. Surv. Illinois, VIII, p. 396.
1895. Helicopora. Simpson, Thirteenth Ann. Rep. State Geologist New York for the year 1893, pp. 722, 726; Forty-seventh Ann. Rep. New York State Museum, pp. 916, 920.
1896. Helicopora. Ulrich, Zittel's Textb. Pal. (Engl. ed.), p. 282.
1897. Helicopora. Simpson, Fourteenth Ann. Rep. State Geologist New York for the year 1894, pp. 517, 522.

Helicopora archimediformis Claypole. See Archimedes laxus (Hall).

Helicopora latispiralis Claypole.

1881. Helicopora latispiralis. Claypole, Proc. American Assoc. Adv. Sci., XXX, p. 191.
1883. Helicopora latispiralis. Claypole, Quar. Jour. Geol. Soc. London, XXXIX, p. 32, pl. iv, 1, 1*a*.
1897. Helicopora latispiralis. Simpson, Fourteenth Ann. Rep. State Geologist New York for the year 1894, fig. 70, 1 (p. 518).
Niagara: Cedarville, Greene County, Ohio.

Helicopora ulrichi Claypole.

1883. Helicopora ulrichi. Claypole, Quar. Jour. Geol. Soc. London, XXXIX, p. 33, pl. iv, 2.
1897. Helicopora ulrichi. Simpson, Fourteenth Ann. Rep. State Geologist New York for the year 1894, fig. 70, 2, 2*a* (p. 518).
Hamilton: Falls of the Ohio.

HELIOTRYPA Ulrich. Genotype: Heliotrypa bifolia Ulrich.

1883. Heliotrypa. Ulrich, Jour. Cincinnati Soc. Nat. Hist., VI, p. 277.
1889. Heliotrypa. Miller, North American Geol. Pal., p. 308.
1890. Heliotrypa. Ulrich, Geol. Surv. Illinois, VIII, p. 404.

otrypa bifolia Ulrich.

1883. Heliotrypa bifolia. Ulrich, Jour. Cincinnati Soc. Nat. Hist., VI, p. 278, pl. xiii, 6–6*c*.
1889. Heliotrypa bifolia. Miller, North American Geol. Pal., fig. 484 (p. 308).
1890. Heliotrypa bifolia. Ulrich, Geol. Surv., Illinois, VIII, fig. 3*f* (p. 308).
Chester: Sloans Valley, Kentucky.

lipora antheloidea Rominger. In error for Stellipora antheloidea.
ee Constellaria constellata (Van Cleve) Dana.

LOPORA Hall. Genotype: Helopora fragilis Hall.

1852. Helopora. Hall, Pal. New York, II, p. 44.
1866. Helopora. Billings, Catal. Sil. Foss. Anticosti, p. 36.
1888. Helopora. Ulrich, American Geologist, I, p. 231.
1889. Helopora. Miller, North American Geol. Pal., p. 308.
1890. Helopora. Ulrich, Geol. Surv. Illinois, VIII, pp. 401, 642.
1890. Helopora. Ulrich, Jour. Cincinnati Soc. Nat. Hist., XII, p. 191.
1893. Helopora. Ulrich, Geol. Minnesota, III, p. 189.
1896. Helopora. Ulrich, Zittel's Textb. Pal. (Engl. ed.), p. 280.
1897. Helopora. Simpson, Fourteenth Ann. Rep. State Geologist New York for the year 1894, p. 548.

pora alternata Ulrich.

1890. Helopora alternata. Ulrich, Jour. Cincinnati Soc. Nat. Hist., XII, p. 192, fig. 16*f*.
1893. Helopora alternata. Ulrich, Geol. Minnesota, III, p. 192, pl. iii, 9.
Trenton (Black River): Minneapolis, Minnesota.

opora approximata James. See Bythopora parvula (James).

pora armata Billings.

1866. Helopora armata. Billings, Catal. Sil. Foss. Anticosti, p. 38.
Anticosti: Anticosti Island.

pora bellula Billings.

1866. Helopora bellula. Billings, Catal. Sil. Foss. Anticosti, p. 38.
Anticosti: Anticosti Island.
Obs. Compare Helopora fragilis Hall, of which this species may be a synonym.

pora ?? circe Billings.

1866. Helopora Circe. Billings, Catal. Sil. Foss. Anticosti, p. 39.
Anticosti: Anticosti Island.

pora ?? concava Billings.

1866. Helopora concava. Billings, Catal. Sil. Foss. Anticosti, p. 37.
Anticosti: Anticosti Island.
Obs. This form may be only a condition of Nematopora formosa (Billings).

opora dendrina James. See Bythopora dendrina (James).

pora divaricata Ulrich.

1886. Helopora divaricata. Ulrich, Fourteenth Ann. Rep. Geol. Nat. Hist. Surv. Minnesota, p. 59.
1893. Helopora divaricata. Ulrich, Geol. Minnesota, III, p. 191, pl. iii, 1–3.
Trenton (Stones River): Minneapolis, Minnesota.

pora elegans Ulrich.

1893. Helopora elegans. Ulrich, Geol. Minnesota, III, p. 194, fig. 11.
Cincinnati (Richmond): Blanchester, Oxford, and other localities in Ohio; Richmond and Versailles, Indiana.

Helopora formosa Billings. See Nematopora formo

Helopora fragilis Hall.

1852. Helopora fragilis. Hall, Pal. New York, II, p. 44, pl.
1874. Helopora fragilis. Nicholson and Hinde, Canadian
p. 141.
1875. Helopora fragilis. Nicholson, Pal. Province Ontario,
1888. Helopora fragilis. Ulrich, American Geologist, I, p.
1889. Helopora fragilis. Miller, North American Geol.
(p. 308).
1890. Helopora fragilis. Ulrich, Geol. Sur. Illinois, VIII.
643), pl. xxix, 5*a*.
Clinton: Rochester, New York.
Niagara: Lockport, New York; Flamborough Head,
Obs. See also Helopora bellula Billings.

Helopora fragilis-acadiensis Hall. Not defined.

1860. Helopora fragilis var. acadiensis. Hall, Canadian N
Silurian: Nova Scotia.

Helopora harrisi James.

1883. Helopora harrisi. James, Paleontologist, No. 7, p. 5
1889. Helopora harrisi. Ulrich, Contr. Micro-Pal. Cambro
1893. Helopora harrisi. Ulrich, Geol. Minnesota, III, p.
1895. Helopora Harrisii. Whiteaves, Pal. Foss., III, Part
1897. Helopora Harrisi. Simpson, Fourteenth Ann. Rep.
York for the year 1894, figs. 113–115 (p. 548).
Cincinnati (Richmond): Waynesville, Blanchester,
Ohio; Stony Mountain, Manitoba.

Helopora imbricata Ulrich.

1890. Helopora imbricata. Ulrich, Geol. Sur. Illinois, VI
Cincinnati (Richmond): Wilmington, Illinois.
Obs. This form may be the tertiary segments of
Ulrich.

Helopora ?? irregularis Billings.

1866. Helopora irregularis. Billings, Catal. Sil. Foss. Ant
Anticosti: Anticosti Island.

Helopora lineata Billings. See Nematopora lineata

Helopora lineopora Billings. See Nematopora ? li

Helopora ?? meeki James.

1878. Helopora meeki. James, Paleontologist, No. 1, p.
Cincinnati: Warren County, Ohio.
Obs. This is in all probability the same as Dicrano
ler and Dyer), but the description given is too me
question.

Helopora mucronata Ulrich.

1890. Helopora mucronata. Ulrich, Jour. Cincinnati So
192, fig. 16*e*.
1893. Helopora mucronata. Ulrich, Geol. Minnesota, III
Trenton: Cannon Falls and St. Paul, Minnesota.

Helopora nodosa Billings.

1866. Helopora nodosa. Billings, Catal. Sil. Foss. Anticos
Anticosti: Anticosti Island.

Helopora parvula James. See Bythopora parvula (

ora quadrata Ulrich.

93. Helopora quadrata. Ulrich, Geol. Minnesota, III, p. 193, fig. 10.
Trenton: Cannon Falls, Minnesota.

ora spiniformis (Ulrich).

82. Arthroclema spiniformis. Ulrich, Jour. Cincinnati Soc. Nat. Hist., V, p. 161, pl. vi, 10, 10*a*.
93. Helopora spiniformis. Ulrich, Geol. Minnesota, III, pl. iii, 4, 5, 6.
96. Helopora spiniformis. Ulrich, Zittel's Textb. Pal. (Engl. ed.), fig. 469 (p. 283).
Trenton (Stones River): Lebanon and Lavergne, Tennessee; Dixon, Illinois.

pora striatopora Billings. See Nematopora striatopora (Billings).

pora strigosa Billings. See Nematopora strigosa (Billings).

pora tenuis James. See Arthrostylus tenuis (James).

ora ?? varipora Billings.

66. Helopora varipora. Billings, Catal. Sil. Foss. Anticosti, p. 40.
Anticosti: Anticosti Island.

IPHRAGMA Ulrich. Genotype: Batostoma irrasum Ulrich.

90. Batostoma (in part). Ulrich, Geol. Sur. Illinois, VIII, p. 379.
93. Hemiphragma. Ulrich, Geol. Minnesota, III, p. 299.
96. Hemiphragma. Ulrich, Zittel's Textb. Pal. (Engl. ed.), p. 275.
97. Hemiphragma. Simpson, Fourteenth Ann. Rep. State Geologist New York for the year 1894, p. 592.

phragma imperfectum (Ulrich).

90. Batostoma imperfectum. Ulrich, Geol. Sur. Illinois, VIII, p. 460, pl. xxxv, 3–3*d*.
93. Hemiphragma imperfectum. Ulrich, Geol. Minnesota, III, p. 301.
94. Monticulipora imperfectum. J. F. James, Jour. Cincinnati Soc. Nat. Hist., XVI, p. 196.
Cincinnati (Richmond): Wilmington, Illinois.

phragma irrasum (Ulrich).

86. Batostoma irrasa. Ulrich, Fourteenth Ann. Rep. Geol. Nat. Hist. Sur. Minnesota, p. 94.
93. Hemiphragma irrasum. Ulrich, Geol. Minnesota, III, p. 299, pl. xxiv, 5–19.
96. Hemiphragma irrasum. Ulrich, Zittel's Textb. Pal. (Engl. ed.), fig. 460 (p. 275).
97. Hemiphragma irrasum. Simpson, Fourteenth Ann. Rep. State Geologist New York for the year 1894, figs. 190–193 (p. 592).
Trenton (Stones River, Black River, and Trenton): Minneapolis, St. Paul, Cannon Falls, and Preston, Minnesota; Decorah, Iowa.

phragma ottawense (Foord).

83. Batostoma Ottawaense. Foord, Contr. Micro-Pal. Cambro-Sil., p. 18, pl. ii, 1–1*f*.
93. Hemiphragma ottawaense. Ulrich, Geol. Minnesota, III, p. 300, pl. xxiv, 1–4.
Trenton (Black River and Trenton): Ottawa and Paquettes Rapids, Ottawa River, Canada; Kenyon, Berne, and Mantorville, Minnesota.

phragma tenuimurale Ulrich.

93. Hemiphragma tenuimurale. Ulrich, Geol. Minnesota, III, p. 301, pl. xxiv, 20–23.
Trenton: Goodhue County, Minnesota.

Hemiphragma whitfieldi (James).

1881. Monticulipora (Chætetes) whitfieldi. James, Paleontologist, No. 5,
1888. Monticulipora whitfieldi. James and James, Jour. Cincinnati Soc
    Hist., X, p. 178.
1894. Monticulipora whitfieldi. J. F. James, Jour. Cincinnati Soc. Nat.
    XVI, p. 200.
    Cincinnati (Utica): Cincinnati, Ohio, and vicinity.

HEMITRYPA Phillips. Genotype: Hemitrypa oculata Phillips.

1841. Hemitrypa. Phillips, Pal. Foss., p. 27.
1844. Hemitrypa. McCoy, Synop. Carb. Foss. Ireland, p. 204.
1874. Hemitrypa. Hall, Twenty-sixth Ann. Rep. New York State Mus., p.
1885. Hemitrypa. Hall, Rep. State Geologist New York for the year 1884,
1886. Hemitrypa. Ulrich, Contr. American Pal., I, p. 4.
1887. Hemitrypa. Foerste, Bull. Sci. Lab. Denison Univ., II, p. 152.
1887. Hemitrypa. Hall and Simpson, Pal. New York, VI, p. xxiii.
1889. Hemitrypa. Miller, North American Geol. Pal., p. 309.
1890. Hemitrypa. Ulrich, Geol. Sur. Illinois, VIII, pp. 396, 559.
1893. Hemitrypa. Cole, Sci. Proc. Roy. Dublin Soc. (n. s.), VIII, p. 132.
1894. Hemitrypa. Počta, Syst. Sil. Bohême, VIII, t. 1, p. 92.
1895. Hemitrypa. Whidborne, Devon. Fauna England (Pal. Soc. Publ.),
    4, p. 177.
1895. Hemitrypa. Simpson, Thirteenth Ann. Rep. State Geologist New
    for the year 1893, pp. 710, 726; Forty-seventh Ann. Rep. New York
    Mus., pp. 904, 920.
1896. Hemitrypa. Ulrich, Zittel's Textb. Pal. (Engl. ed.), p. 282.
1897. Hemitrypa. Simpson, Fourteenth Ann. Rep. State Geologist New
    for the year 1894, pp. 507, 520.

Hemitrypa aspera Ulrich.

1890. Hemitrypa aspera. Ulrich, Geol. Sur. Illinois, VIII, p. 563, pl. lvii, 4–
1894. Hemitrypa aspera. Keyes, Missouri Geol. Sur., V, p. 25.
    Keokuk: Keokuk and Bentonsport, Iowa; Nauvoo, Illinois.

Hemitrypa biordo Hall.

1885. Hemitrypa biordo. Hall, Rep. State Geologist New York for the yea
    p. 36, pl. ii, 11.
1887. Fenestella (Hemitrypa) biordo. Hall and Simpson, Pal. New Yor
    p. 149.
1889. Hemitrypa biordo. Miller, North American Geol. Pal., fig. 487 (p. 3
    Upper Helderberg: Walpole, Ontario.

Hemitrypa biserialis (Hall).

1879. Fenestella (Hemitrypa) biserialis. Hall, Thirty-second Ann. Rep
    York State Mus., p. 174 (reprint, 1880, p. 36).
1883. Fenestella (Hemitrypa) biserialis (in part). Hall, Rep. State Ge
    New York for the year 1882, pl. xxii, 13–18.
1887. Fenestella (Hemitrypa) biserialis. Hall and Simpson, Pal. New Yor
    p. 57, pl. xxii, 13, 16–18.
    Lower Helderberg: Clarksville, New York.

Hemitrypa biserialis-exilis (Hall and Simpson).

1883. Fenestella (Hemitrypa) biserialis (in part). Hall, Rep. State Ge
    New York for the year 1882, pl. xxii, 13–18.
1887. Fenestella (Hemitrypa) biserialis var. exilis. Hall and Simpson
    New York, VI, p. 57, pl. xxii, 14, 15.
    Lower Helderberg: Clarksville, New York.

trypa columellata (Hall and Simpson).

87. Fenestella (Hemitrypa) columellata. Hall and Simpson, Pal. New York, VI, p. 146.

97. Hemitrypa columellata. Simpson, Fourteenth Ann. Rep. State Geologist New York for the year 1894, figs. 51–53 (p. 508), pl. v, 3–11.

Upper Helderberg: Walpole, Ontario.

trypa cribrosa (Hall).

83. Fenestella (Hemitrypa) cribrosa. Hall, Trans. Albany Institute, X, p. 177 (abstract, 1881, p. 35).

87. Fenestella (Hemitrypa) cribrosa. Hall and Simpson, Pal. New York, VI, p. 145.

97. Hemitrypa cribrosa. Simpson, Fourteenth Ann. Rep. State Geologist New York for the year 1894, pl. v, 1, 2.

Hamilton: Falls of the Ohio.

trypa dubia Hall. See Loculipora ambigua (Hall).

trypa favosa (Hall).

83. Fenestella (Hemitrypa) favosa. Hall, Trans. Albany Institute, X, p. 177 (abstract, 1881, p. 35).

87. Fenestella (Hemitrypa) favosa. Hall and Simpson, Pal. New York, VI, p. 148.

Upper Helderberg: Walpole, Ontario.

trypa hemitrypa (Prout) Keyes. See Hemitrypa proutana Ulrich.

trypa nodosa Ulrich.

90. Hemitrypa nodosa. Ulrich Geol. Sur. Illinois, VIII, p. 562, pl. lvii, 3.

94. Hemitrypa nodosa. Keyes, Missouri Geol. Sur., V, p. 25.

Keokuk: Nauvoo, Illinois; Keokuk and Bentonsport, Iowa.

trypa pateriformis Ulrich.

90. Hemitrypa pateriformis. Ulrich, Geol. Sur. Illinois, VIII, p. 564, pl. lvii, 7–7*c*.

94. Hemitrypa pateriformis. Keyes, Missouri Geol. Sur., V, p. 26.

Keokuk: Keokuk, Iowa.

trypa perstriata Ulrich.

90. Hemitrypa perstriata. Ulrich, Geol. Sur. Illinois, VIII, p. 564, pl. lvii, 6, 6*a*.

94. Hemitrypa perstriata. Keyes, Missouri Geol. Sur., V, p. 25.

Keokuk: Keokuk and Bentonsport, Iowa.

trypa plumosa (Prout).

58. Fenestella plumosa. Prout, Trans. St. Louis Acad. Sci., I, p. 236. pl. xv, 2, 2*a*.

89. Hemitrypa plumosa. Miller, North American Geol. Pal., p. 309.

Warsaw: Warsaw, Illinois; Barretts Station, Missouri.

trypa prima Hall. See Unitrypa nervia (Hall).

trypa proutana Ulrich.

59. Fenestella hemitrypa. Prout, Trans. St. Louis Acad. Sci., I, p. 444, pl. xvii, 4, 4*a*.

90. Hemitrypa proutana. Ulrich, Geol. Sur. Illinois, VIII, p. 560, pl. lvii, 1–1*c*.

94. Hemitrypa hemitrypa. Keyes, Missouri Geol. Sur., V, p. 25.

Keokuk: Warsaw, Illinois; Keokuk, Iowa.

Warsaw: Warsaw and Monroe County, Illinois; Barretts Station, Missouri.

St. Louis: Caldwell County, Kentucky.

Hemitrypa proutana-nodulosa Ulrich.
1890. Hemitrypa proutana var. nodulosa. Ulrich, Geol. Sur. Illi
p. 562, pl. lvii, 2–2*c*.
Keokuk: Bentonsport and Keokuk, Iowa; Nauvoo, Illinois.

Hemitrypa proutana-vermifera Ulrich.
1890. Hemitrypa proutana var. vermifera. Ulrich, Geol. Sur. Illi
p. 561, pl. lvii, 5, 5*a*.
Warsaw: Warsaw, Illinois.

Hemitrypa tenera Ulrich.
1890. Hemitrypa tenera. Ulrich, Geol. Sur. Illinois, VIII, p. 55
7, 7*a*, pl. liv, 10–10*c*.
Hamilton: Davenport and Buffalo, Iowa; Rock Island, Illinoi

Hemitrypa ulrichi Foerste.
1887. Hemitrypa ulrichi. Foerste, Bull. Sci. Lab. Denison Univ.,
ibid., III, 1888, pl. xv, 2.
1895. Hemitrypa ulrichi. Foerste, Geol. Sur. Ohio, VII, p. 599, pl.
Clinton: Near New Carlisle, Ohio.

HERNODIA Hall. Genotype: Hernodia humifusa Hall.
1883. Hernodia Hall, Trans. Albany Institute, X, p. 196 (abstrac
196).
1884. Hernodia. Hall, Rep. State Geologist New York for the year
1887. Hernodia. Hall and Simpson, Pal. New York, VI, p. xxvi.
1889. Hernodia. Miller, North American Geol. Pal., p. 309.
1897. Hernodia. Simpson, Fourteenth Ann. Rep. State Geologist Ne
the year 1894, p. 596.

Hernodia humifusa Hall.
1883. Hernodia humifusa. Hall, Trans. Albany Institute, X, p. 19
1881, p. 196).
1884. Hernodia humifusa. Hall, Rep. State Geologist New York f
1883, p. 58.
1887. Hernodia humifusa. Hall and Simpson, Pal. New York, VI,
lxv, 20, 21.
1897. Hernodia humifusa. Simpson, Fourteenth Ann. Rep. Stat
New York for the year 1894, pl. xxv, 1, 2.
Hamilton: Cazenovia, Madison County, New York; Falls of th

Heterodictya Nicholson. See Ptilodictya Lonsdale.

Heterodictya gigantea Nicholson. See Ptilodictya gigantea
son).

Heterodictya pavonia Ulrich. See Escharopora pavonia (D'

HETEROTRYPA Nicholson. Genotype: Monticulipora
D'Orbigny (not Nicholson).
1879. Heterotrypa (in part). Nicholson, Pal. Tabulate Corals, p. 29
1881. Heterotrypa. Nicholson, Genus Monticulipora, pp. 101, 103.
1882. Heterotrypa. Ulrich, Jour. Cincinnati Soc. Nat. Hist., V, p.
VI, 1883, p. 83.
1883. Heterotrypa. Foord, Contr. Micro-Pal. Cambro-Sil., p. 20.
1890. Heterotrypa. Ulrich, Geol. Sur. Illinois, VIII, pp. 371, 413.
1893. Heterotrypa. Ulrich, Geol. Minnesota, III, p. 267.
1896. Heterotrypa (in part). Zittel's Textb. Pal. (Engl. ed.), p. 10
1896. Heterotrypa. Ulrich, Zittel's Textb. Pal. (Engl. ed.), p. 273.
1897. Heterotrypa. Simpson, Fourteenth Ann. Rep. State Geologist
for the year 1894, p. 578.

ypa affinis (Ulrich).

Amplexopora affinis. Ulrich, Geol. Sur. Illinois, VIII, p. 450, pl. xxxvi, 2, 2*a*.

Cincinnati (Richmond): Wilmington, Illinois; Richmond, Indiana.

ypa ? barrandei (Nicholson).

Chætetes Barrandi. Nicholson, Geol. Mag., new ser., I, p. 57, pl. iv. 7*c*.

Chætetes Barrandi. Nicholson, Pal. Province Ontario, p. 60, fig. 17*c*.

Monticulipora (Heterotrypa) Barrandi. Nicholson, Genus Monticulipora, p. 139, pl. i, 2–2*d*.

Amplexopora barrandi. Ulrich, Jour. Cincinnati Soc. Nat. Hist., V, p. 255.

Hamilton: Widder, Ontario.

ypa frondosa (D'Orbigny).

Monticulipora frondosa. D'Orbigny, Prodr. de Pal., I, p. 25.

Chætetes frondosus. Milne-Edwards and Haime, Pol. Foss. Terr. Pal., p. 267, pl. xix, 5, 5*a*.

Monticulipora frondosa. Milne-Edwards and Haime, Brit. Foss. Corals, p. 265.

Monticulipora frondosa. Milne-Edwards, Hist. Nat. des Corall., III, p. 276.

Monticulipora frondosa. White, Eleventh Ann. Rep. Indiana Geol. Nat. Hist., p. 380, pl. xlviii, 2, 3.

Heterotrypa frondosa. Ulrich, Jour. Cincinnati Soc. Nat. Hist., V, p. 235.

Chætetes frondosus. Quenstedt, Roehren- und Sternkorallen, p. 73, pl. cxlvi, 8 (not 3–5).

Chætetes frondosus limatus. Quenstedt, Roehren- und Sternkorallen, p. 74, pl. cxlvi, 9.

Chætetes mammulatus (not of D'Orbigny). Nicholson, Quar. Jour. Geol. Soc. London, XXX, p. 508, pl. xxx, 2-2*b*.

Chætetes mammulatus (not of D'Orbigny). Nicholson, Pal. Ohio, II, p. 207.

Monticulipora (Heterotrypa) mammulata (not of D'Orbigny). Nicholson, Pal. Tabulate Corals, p. 294, pl. xiii, 1–1*b*.

Monticulipora (Heterotrypa) mammulata (not of D'Orbigny). Nicholson, Genus Monticulipora, p. 104, pl. vi, 1–1*g*.

Monticulipora mammulata (not of D'Orbigny). James and James, Jour. Cincinnati Soc. Nat. Hist., XI, p. 16.

Monticulipora mammulata (not of D'Orbigny). J. F. James, Jour. Cincinnati Soc. Nat. Hist., XVIII, p. 69.

Cincinnati (Lorraine): Cincinnati, Ohio, and vicinity.

ypa inflecta Ulrich.

Heterotrypa inflecta. Ulrich, Geol. Sur. Illinois, VIII, p. 414, pl. xxxvii, 2–2*d*.

Monticulipora inflecta. J. F. James, Jour. Cincinnati Soc. Nat. Hist., XVIII, p. 77.

Cincinnati (Lorraine): Cincinnati, Ohio, and vicinity.

ypa ? moniliformis (Nicholson).

Chætetes moniliformis. Nicholson, Geol. Mag., new ser., I, p. 57, pl. iv, 7*a*, 7*b*.

Chætetes moniliformis. Nicholson, Pal. Province Ontario, p. 60, fig. 17*a*, *b*.

Monticulipora (Heterotrypa) moniliformis. Nicholson, Genus Monticulipora, p. 137, pl. i, 1–1*c*.

Heterotrypa ? moniliformis (Nicholson)—Continued.

1882. Amplexopora moniliformis. Ulrich, Jour. Cincinnati Soc. Nat. Hi
p. 255.
Hamilton: Widder, Ontario.

Heterotrypa paupera (Ulrich).

1883. Dekayia paupera. Ulrich, Jour. Cincinnati Soc. Nat. Hist., VI, p. 1
vi, 10, 10*a*.
Cincinnati (Lorraine): Cincinnati, Ohio, and vicinity.

Heterotrypa prolifica Ulrich. See Heterotrypa subramosa-pro
Ulrich.

Heterotrypa singularis Ulrich.

1890. Heterotrypa singularis. Ulrich, Geol. Sur. Illinois, VIII, p. 415, pl. x
3–3*e*.
1893. Heterotrypa singularis. Ulrich, Geol. Minnesota, III, p. 268.
1895. Monticulipora singularis. J. F. James, Jour. Cincinnati Soc. Nat.
XVIII, p. 77.
1897. Heterotrypa singularis. Simpson, Fourteenth Ann. Rep. State Ge
New York for the year 1894, fig. 147 (p. 579).
Cincinnati (Richmond): Wilmington, Illinois; Iron Ridge, Wiscons

Heterotrypa solitaria Ulrich.

1883. Heterotrypa solitaria. Ulrich, Jour. Cincinnati Soc. Nat. Hist., VI,
pl. i, 3–3*b*.
Cincinnati (Lorraine): Covington, Kentucky; Maury County, Tenn

Heterotrypa subpulchella (Nicholson).

1875. Chætetes subpulchellus. Nicholson, Pal. Ohio, II, p. 196, pl. xxi,
1881. Monticulipora (Heterotrypa) subpulchella. Nicholson, Genus Mon
pora, p. 134, fig. 23, pl. v, 2, 2*a*.
1883. Heterotrypa subpulchella. Ulrich, Jour. Cincinnati Soc. Nat. Hist
p. 83.
1888. Monticulipora subpulchella. James and James, Jour. Cincinnati So
Hist., X, p. 181.
1894. Monticulipora subpulchella. J. F. James, Jour. Cincinnati Soc. Nat.
XVI, p. 204.
Cincinnati (Lorraine): Cincinnati, Ohio, and vicinity.

Heterotrypa subramosa (Ulrich).

1879. Atactopora subramosa. Ulrich, Jour. Cincinnati Soc. Nat. Hist.,
124, pl. xii, 6–6*c*.
Cincinnati (Richmond): Jacksonburg and Hanover, Ohio.
Obs. See also Monticulipora ?? clintonensis James.

Heterotrypa subramosa-prolifica Ulrich.

1890. Heterotrypa prolifica. Ulrich, Geol. Sur. Illinois, VIII, p. 413, pl. x
1–1*d*.
1893. Heterotrypa prolifica. Ulrich, Geol. Minnesota, III, p. 268.
1895. Monticulipora prolifica. J. F. James, Jour. Cincinnati Soc. Nat.
XVIII, p. 75.
1897. Heterotrypa prolifica. Simpson, Fourteenth Ann. Rep. State Ge
New York for the year 1894, figs. 145, 146 (p. 579).
Cincinnati (Richmond): Blanchester, Waynesville, and other localit
Ohio; Richmond and Versailles, Indiana; Wilmington, Illinois;
Ridge, Wisconsin.

Heterotrypa vaupeli Ulrich. See Nicholsonella vaupeli (Ulrich).

XAGONELLA Waagen and Wentzel. Genotype: Hexagonella amosa Waagen and Wentzel.

1886. Hexagonella. Waagen and Wentzel, Pal. Indica, Ser. XIII, pp. 909, 911.
Obs.—This genus is known in America by two undescribed species, one from the Hamilton at the Falls of the Ohio, the other from the Warsaw at Clarksville, Tennessee.

ppothoa Lamouroux. Not a Paleozoic genus.

ppothoa delicatula James. See Stomatopora delicatula (James).

ppothoa inflata Nicholson. See Stomatopora inflata (Hall).

MOTRYPA Ulrich. Genotype: Homotrypa curvata Ulrich.

1882. Homotrypa. Ulrich, Jour. Cincinnati Soc. Nat. Hist., V, p. 240.
1883. Homotrypa. Foord, Contr. Micro-Pal. Cambro-Sil., p. 9.
1889. Homotrypa. Miller, North American Geol. Pal., p. 309.
1890. Homotrypa. Ulrich, Geol. Sur. Illinois, VIII, pp. 370, 409.
1893. Homotrypa. Ulrich, Geol. Minnesota, III, p. 235.
1896. Homotrypa. Ulrich, Zittel's Textb. Pal., (Engl. ed.), p. 273.
1897. Homotrypa. Simpson, Fourteenth Ann. Rep. State Geologist New York for the year 1894, p. 575.

notrypa ? arbuscula Ulrich.

1890. Homotrypa arbuscula. Ulrich, Geol. Sur. Illinois, VIII, p. 409, pl. xxxviii, 3–3*c*.
1894. Homotrypa arbuscula. Keyes, Missouri Geol. Sur., V, p. 13.
Trenton (Stones River): High Bridge, Kentucky; Calhoun County and Dixon, Illinois.

notrypa callosa Ulrich.

1893. Homotrypa callosa. Ulrich, Geol. Minnesota, III, p. 243, pl. xx, 15–21.
1897. Homotrypa callosa. Simpson, Fourteenth Ann. Rep. State Geologist New York for the year 1894, figs. 139, 140 (p. 576).
Trenton: Burgin, Frankfort, and Garrard County, Kentucky; Cannon Falls, Minnesota.

notrypa ? confluens (Foerste).

1887. Monotrypella confluens. Foerste, Bull. Sci. Lab. Denison Univ., II, p. 172; ibid., III, 1888, pl. xvi, 4.
1895. Homotrypa confluens. Foerste, Geol. Sur. Ohio, VII, p. 600.
Clinton: Dayton, Ohio.

notrypa curvata Ulrich.

1882. Homotrypa curvata. Ulrich, Jour. Cincinnati Soc. Nat. Hist., V, p. 242, pl. x, 7–7*d*.
1895. Monticulipora curvata. J. F. James, Jour. Cincinnati Soc. Nat. Hist., XVIII, p. 71.
1897. Homotrypa curvata. Simpson, Fourteenth Ann. Rep. State Geologist New York for the year 1894, figs. 137, 138 (p. 576).
Cincinnati (Lorraine): Cincinnati, Ohio, and vicinity.

notrypa dawsoni (Nicholson).

1881. Monticulipora (Heterotrypa) Dawsoni. Nicholson, Genus Monticulipora, p. 141, pl. v, 3–3*f*.
1882. Monticulipora dawsoni. Ulrich, Jour. Cincinnati Soc. Nat. Hist., V, p. 241.
1888. Monticulipora dawsoni. James and James, Jour. Cincinnati Soc. Nat. Hist., XI, p. 15.

Homotrypa dawsoni (Nicholson)—Continued.

1895. Monticulipora dawsoni. J. F. James, Jour. Cincinnati Soc. Nat. XVIII, p. 68.

Cincinnati (Lorraine and Richmond): Cincinnati, Waynesville, Clarks and Oregonia, Ohio; Versailles, Indiana.

Homotrypa exilis Ulrich.

1886. Homotrypa exilis. Ulrich, Fourteenth Ann. Rep. Geol. Nat. Hist Minnesota, p. 80.

1893. Homotrypa exilis. Ulrich, Geol. Minnesota, III, p. 236, pl. xix, 10–1

Trenton (Stones River): Minneapolis, Minnesota.

Homotrypa flabellaris Ulrich.

1890. Homotrypa flabellaris. Ulrich, Geol. Sur. Illinois, VIII, p. 411, pl. 3–3*c*.

1895. Monticulipora flabellaris. J. F. James, Jour. Cincinnati Soc. Nat. XVIII, p. 75.

Cincinnati (Lorraine and Richmond): Wilmington, Illinois; a co form in the Lorraine and Richmond groups of Ohio, Indiana, Kent and Tennessee.

Homotrypa gelasinosa Ulrich.

1890. Homotrypa gelasinosa. Ulrich, Geol. Sur. Illinois, VIII, p. 410, pl. 2–2*d*.

1894. Monticulipora gelasinosa. J. F. James, Jour. Cincinnati Soc. Nat. XVI, p. 202.

Cincinnati (Richmond): Wilmington, Illinois.

Homotrypa insignis Ulrich. See Homotrypa subramosa-ins Ulrich.

Homotrypa ? intercalaris Ulrich.

1893. Homotrypa ? intercalaris. Ulrich, Geol. Minnesota, III, p. 238, fig. 1

Trenton (Black River): St. Paul and Minneapolis, Minnesota.

Homotrypa minnesotensis Ulrich.

1886. Homotrypa minnesotensis. Ulrich, Fourteenth Ann. Rep. Geol Hist. Sur. Minnesota, p. 79.

1893. Homotrypa minnesotensis. Ulrich, Geol. Minnesota, III, p. 235, p 1–9.

Trenton (Stones River and Black River): Minneapolis, St. Paul, Lane Cannon Falls, Preston, and Fountain, Minnesota; Decorah, Iowa; ville, Kentucky; Hartsville, Tennessee.

Homotrypa minnesotensis-montifera Ulrich.

1893. Homotrypa minnesotensis var. montifera. Ulrich, Geol. Minnesot p. 236, pl. xix, 3*a*.

Trenton (Black River): St. Paul, Minnesota.

Homotrypa obliqua Ulrich.

1882. Homotrypa obliqua. Ulrich, Jour. Cincinnati Soc. Nat. Hist., V, pl. x, 6, 6*b*.

1889. Homotrypa obliqua. Miller, North American Geol. Pal., fig. 489 (p

1896. Homotrypa obliqua. J. F. James, Jour. Cincinnati Soc. Nat. Hist., X p. 124.

Cincinnati (Lorraine): Cincinnati, Ohio, and vicinity.

Homotrypa separata Ulrich.

1893. Homotrypa separata. Ulrich, Geol. Minnesota, III, p. 237, pl. xix, 1

Trenton (Stones River): Minneapolis, Chatfield, and Preston, Minn

omotrypa ? similis Foord.

1883. Homotrypa similis. Foord, Contr. Micro-Pal. Cambro-Sil., p. 10, pl. ii, 2–2*d*.

1893. Homotrypa similis. Ulrich, Geol. Minnesota, III, p. 242, pl. xx, 28–33.

Trenton: Ottawa City, Ottawa; St. Paul, Cannon Falls, and Kenyon, Minnesota.

omotrypa ? solida (Hall).

1852. Trematopora solida. Hall, Pal. New York, II, p. 153, pl. xlA, 6*a*–*c*.

Niagara: Lockport, New York.

omotrypa subramosa Ulrich.

1886. Homotrypa subramosa. Ulrich, Fourteenth Ann. Rep. Geol. Nat. Hist. Sur. Minnesota, p. 81.

1893. Homotrypa subramosa. Ulrich, Geol. Minnesota, III, p. 239, pl. xix, 21–28.

1896. Homotrypa subramosa. Ulrich, Zittel's Textb. Pal. (Engl. ed.), fig. 451 A–C (not D = Homotrypa separata Ulrich) (p. 273).

Trenton (Black River): St. Paul, Minneapolis, and Goodhue County, Minnesota.

omotrypa subramosa-insignis Ulrich.

1886. Homotrypa insignis. Ulrich, Fourteenth Ann. Rep. Geol. Nat. Hist. Sur. Minnesota, p. 82.

1893. Homotrypa subramosa var. insignis. Ulrich, Geol. Minnesota, III, p. 239.

Trenton: St. Paul and Goodhue and Fillmore counties, Minnesota; Decorah, Iowa.

omotrypa tuberculata Ulrich.

1893. Homotrypa tuberculata. Ulrich, Geol. Minnesota, III, p. 240, fig. 14.

Trenton (Black River): Cannon Falls, Minnesota.

OMOTRYPELLA Ulrich. Genotype: Homotrypella instabilis Ulrich.

1886. Homotrypella. Ulrich, Fourteenth Ann. Rep. Geol. Nat. Hist. Sur. Minnesota, p. 83.

1889. Homotrypella. Miller, North American Geol. Pal., p. 310.

1890. Homotrypella. Ulrich, Geol. Sur. Illinois, VIII, pp. 370, 412.

1893. Homotrypella. Ulrich, Geol. Minnesota, III, p. 228.

1897. Homotrypella. Simpson, Fourteenth Ann. Rep. State Geologist New York for the year 1894, p. 586.

omotrypella contexta Ulrich.

1890. Homotrypella contexta. Ulrich, Geol. Sur. Illinois, VIII, p. 412, pl. xxxii, 5–5*b*.

1895. Monticulipora contexta. J. F. James, Jour. Cincinnati Soc. Nat. Hist., XVIII, p. 74.

Cincinnati (Richmond): Wilmington, Illinois.

omotrypella gracilis Ulrich. See Bythopora gracilis (Nicholson)

omotrypella granulifera (Ulrich.)

1879. Chætetes granuliferus. Ulrich, Jour. Cincinnati Soc. Nat. Hist., II, p. 128, pl. xii, 9–9*b*.

1882. Batostomella granulifera. Ulrich, Jour. Cincinnati Soc. Nat. Hist., V, p. 141.

1889. Homotrypella granulifera. Miller, North American Geol. Pal., p. 310.

1896. Monticulipora (Fistulipora) granulifera. J. F. James, Jour. Cincinnati Soc. Nat. Hist., XVIII, p. 120.

Trenton: Burgin and Frankfort, Kentucky.

Homotrypella instabilis Ulrich.

1886. Homotrypella instabilis. Ulrich, Fourteenth Ann. Rep. Geol. Nat. Sur. Minnesota, p. 83.

1893. Homotrypella instabilis. Ulrich, Geol. Minnesota, III, p. 229, pl. 9–20.

1897. Homotrypella instabilis. Simpson, Fourteenth Ann. Rep. State Geo New York for the year 1894, figs. 168, 169 (p. 586).

Trenton (Black River): Minneapolis, St. Paul, Cannon Falls, and tain, Minnesota.

Homotrypella meeki Ulrich. See Bythopora meeki (James).

Homotrypella multiporata Ulrich.

1893. Homotrypella multiporata. Ulrich, Geol. Minnesota, III, p. 230, pl. 21, 22.

Trenton (Black River): St. Paul and Minneapolis, Minnesota.

Homotrypella mundula Ulrich.

1893. Homotrypella mundula. Ulrich, Geol. Minnesota, III, p. 232, fig. 12a

Trenton: Decorah, Iowa; Cannon Falls, Minnesota; Frankfort, Kent

Homotrypella ? ovata Ulrich.

1893. Homotrypella ? ovata. Ulrich, Geol. Minnesota, III, p. 231, pl. 23–30.

Trenton (Black River and Trenton): Cannon Falls and Minnea Minnesota.

Homotrypella rustica Ulrich.

1893. Homotrypella rustica. Ulrich, Geol. Minnesota, III, p. 234, pl. xviii,

1896. Monticulipora (Fistulipora) rustica. J. F. James, Jour. Cincinnat Nat. Hist., XVIII, p. 120.

Cincinnati (Richmond): Spring Valley, Minnesota.

Homotrypella ? subgracilis Ulrich.

1893. Homotrypella ? subgracilis. Ulrich, Geol. Minnesota, III, p. 230, pl. 10–16.

Trenton (Black River): Minneapolis and St. Paul, Minnesota.

Obs. This species may be a Bythopora.

Hornera Lamouroux. Not a Paleozoic genus.

Hornera ? dichotoma Hall. See Thamniscus dichotomus (Hall).

HYPHASMOPORA Etheridge, Jun. Genotype: Hyphasmopora b Etheridge, Jun., from the Carboniferous shales of Scotland.

1875. Hyphasmopora. Etheridge, Jun., Ann. Mag. Nat. Hist., ser. 4, XV, p

1889. Hyphasmopora. Vine, Proc. Yorkshire Geol. Polyt. Soc., XI, p. 188.

Obs. No American species have yet been referred to this genus.

ICHTHYORACHIS McCoy. Genotype: Ichthyorachis newen McCoy.

1844. Ichthyorachis. McCoy, Syn. Carb. Foss. Ireland, p. 205.

1887. Ichthyorachis. Hall and Simpson, Pal. New York, VI, p. xxv.

1889. Ichthyorachis. Miller, North American Geol. Pal., p. 310.

1897. Ichthyorachis. Simpson, Fourteenth Ann. Rep. State Geologist York for the year 1894, p. 524.

Ichthyorachis nereis Hall.

1874. Ichthyorachis Nereis. Hall, Twenty-sixth Ann. Rep. New York Museum, p. 98.

thyorachis nereis Hall—Continued.

1879. Ichthyorachis Nereis. Hall, Thirty-second Ann. Rep. New York State Museum, p. 174 (reprint, 1880, p. 36).
1883. Ichthyorachis Nereis. Hall, Rep. State Geologist New York, for the year 1882, pl. xxii, 19–21.
1887. Ichthyorachis Nereis. Hall and Simpson, Pal. New York, VI, p. 66, pl. xxii, 19–21.
1897. Ichthyorachis Nereis. Simpson, Fourteenth Ann. Rep. State Geologist New York for the year 1894, pl. viii, 19–21.
Lower Helderberg: Schoharie, New York.

OTRYPA Ulrich. Genotype: Idiotrypa parasitica Ulrich.

1883. Idiotrypa. Ulrich, Jour. Cincinnati Soc. Nat. Hist., VI, p. 272.
1889. Idiotrypa. Miller, North American Geol. Pal., p. 310.
1890. Idiotrypa. Ulrich, Geol. Sur. Illinois, VIII, p. 375.
1897. Idiotrypa. Simpson, Fourteenth Ann. Rep. State Geologist New York for the year 1894, p. 591.

trypa parasitica Ulrich.

1883. Idiotrypa parasitica. Ulrich, Jour. Cincinnati Soc. Nat. Hist., VI, p. 273, pl. xiii, 1–1*c*.
1897. Idiotrypa parasitica. Simpson, Fourteenth Ann. Rep. State Geologist New York for the year 1894, figs. 187–189 (p. 591).
Niagara: Osgood, Indiana.

RAPORA Hall. Genotype: Intrapora puteolata Hall.

1883. Intrapora. Hall, Trans. Albany Institute, X, p. 157 (abstract, 1881, p. 16).
1887. Intrapora. Hall and Simpson, Pal. New York, VI, p. xxii.
1889. Intrapora. Miller, North American Geol. Pal., p. 310.
1890. Intrapora. Ulrich, Geol. Sur. Illinois, VIII, p. 394.
1897. Intrapora. Simpson, Fourteenth Ann. Rep. State Geologist New York for the year 1894, p. 535.
Obs. See also Coscinella Hall and Simpson.

apora basalis Ulrich.

1890. Stictoporella basalis. Ulrich, Geol. Sur. Illinois, VIII, p. 532, pl. lxxv, 5–5*c*, pl. lxviii, 5, 5*a*, pl. lxix, 2, 2*a*.
1894. Stictoporella basalis. Keyes, Missouri Geol. Sur., V, p. 22.
1897. Stictoporella basalis. Simpson, Fourteenth Ann. Rep. State Geologist New York for the year ending 1894, figs. 91, 92 (p. 536).
Warsaw: Warsaw, Illinois.

apora cosciniformis Ulrich. See Coscinella cosciniformis (Nicholson.

apora elegantula Whiteaves. See Coscinella elegantula Hall and impson.

apora puteolata Hall.

1883. Intrapora puteolata. Hall, Trans. Albany Institute, X, p. 158 (abstract, 1881, p. 16).
1886. Intrapora puteolata. Hall, Fifth Ann. Rep. State Geologist New York for the year 1885, pl. xxix, 18–26.
1887. Intrapora puteolata. Hall and Simpson, Pal. New York, VI, p. 97, pl. xxix, 18–26.
1897. Intrapora puteolata. Simpson, Fourteenth Ann. Rep. State Geologist New York for the year 1894, pl. xi, 1–9.
Hamilton: Falls of the Ohio.

Intrapora undulata (Ulrich).

1890. Stictoporella ? undulata. Ulrich, Geol. Sur. Illinois, VIII, p. 53 6–6*b*.

Chester: Litchfield, Kentucky.

Intricaria Defrance. Not a Paleozoic genus.

Intricaria clathrata Miller and Dyer. See Phylloporina (Miller and Dyer).

Intricaria ? reticulata Hall. See Phylloporina reticulata (Ha

ISOTRYPA Hall. Genotype: Fenestella (Isotrypa) conjuncti

1885. Isotrypa. Hall, Rep. State Geologist New York for the year 18
1887. Isotrypa. Hall and Simpson, Pal. New York, VI, p. xxiii.
1889. Isotrypa. Miller, North American Geol. Pal., p. 310.
1890. Isotrypa (emend.). Ulrich, Geol. Sur. Illinois, VIII, p. 395.
1895. Isotrypa. Simpson, Thirteenth Ann. Rep. State Geologist Ne the year 1893, pp. 689, 714, 726; Forty-seventh Ann. Rep. New Museum, pp. 883, 908, 920.
1895. Isotrypa. Whidborne, Devon. Fauna England, (Pal. Soc. Publ 4, p. 180.
1897. Isotrypa. Simpson, Fourteenth Ann. Rep. State Geologist Ne the year 1894, pp. 510, 520.
1895. Tectuliporella. Simpson, Thirteenth Ann. Rep. State Geologist for the year 1893, pp. 715, 726; Forty-seventh Ann. Rep. New Museum, pp. 909, 920.
1897. Tectuliporella. Simpson, Fourteenth Ann. Rep. State Geologist for the year 1894, pp. 510, 520.

Obs. Specimens of the type species of Tectuliporella show th on the reverse side is frequently wanting and generally not developed. Hence there is no ground for Tectuliporella.

Isotrypa ambigua Ulrich. See Loculipora ambigua (Hall).

Isotrypa bifaria Hall. See Isotrypa conjunctiva (Hall).

Isotrypa conjunctiva (Hall).

1883. Fenestella (Hemitrypa) conjunctiva. Hall, Trans. Albany In p. 178 (abstract, 1881, p. 36).
1887. Fenestella (Isotrypa) conjunctiva. Hall and Simpson, Pal. VI, p. 143, pl. liv, 10–21.
1889. Isotrypa conjunctiva. Miller, North American Geol. Pal., fig. 4
1897. Isotrypa conjunctiva. Simpson, Fourteenth Ann. Rep. State New York for the year 1894, fig. 59 (p. 310), pl. vi, 7–12.
1885. Isotrypa bifaria (in error). Hall, Rep. State Geologist New Y year 1884, pl. ii, 13, 16.

Upper Helderberg: Walpole, Ontario.

Isotrypa consimilis Hall.

1885. Isotrypa consimilis. Hall, Rep. State Geologist New York fo 1884, pl. ii, 14.
1887. Fenestella (Unitrypa?) consimilis. Hall and Simpson, Pal. VI, p. 142, pl. liv, 7–9.
1897. Tectuliporella consimilis. Simpson, Fourteenth Ann. Rep. St gist New York for the year 1894, pl. vi, 13–15.

Upper Helderberg: Walpole, Ontario.

Leioclema. See Lioclema.

lema singulare Ulrich. See Trematopora ? singularis (Hall).

OTRYPA Ulrich. Genotype: Leptotrypa minima Ulrich.

83. Leptotrypa. Ulrich, Jour. Cincinnati Soc. Nat. Hist., VI, p. 158.
89. Leptotrypa. Miller, North American Geol. Pal., p. 311.
90. Leptotrypa. Ulrich, Geol. Sur. Illinois, VIII, pp. 377, 455.
93. Leptotrypa. Ulrich, Geol. Minnesota, III, p. 316.
97. Leptotrypa. Simpson, Fourteenth Ann. Rep. State Geologist New York for the year 1894, p. 580.

trypa ? acervulosa Ulrich.

93. Leptotrypa acervulosa. Ulrich, Geol. Minnesota, III, p. 318, pl. xxvii, 24, 25.

Trenton: Decorah, Iowa; Goodhue County, Minnesota; Burgin and Frankfort, Kentucky.

trypa calceola (Miller and Dyer).

78. Monticulipora calceola. Miller and Dyer, Jour. Cincinnati Soc. Nat. Hist., I, p. 26, pl. i, 11, 11*a*.
81. Monticulipora (Monotrypa) calceola. Nicholson, Genus Monticulipora, p. 185, pl. i, 3–3*e*.
83. Leptotrypa calceola. Ulrich, Jour. Cincinnati Soc. Nat. Hist., VI, p. 159.
88. Monticulipora calceola. James and James, Jour. Cincinnati Soc. Nat. Hist., XI, p. 27.
95. Monticulipora calceola. J. F. James, Jour. Cincinnati Soc. Nat. Hist., XVIII, p. 87.

Cincinnati (Lorraine): Cincinnati, Ohio.

trypa clavacoidea (James).

71. Chætetes clavacoideus. James, Catal. Lower Sil. Foss., p. 1. (Only named.)
75. Chætetes clavacoideus. James, Catal. Foss. Cincinnati Group, p. 1.
81. Monticulipora (Monotrypa) clavacoidea. Nicholson, Genus Monticulipora, p. 182, fig. 37.
83. Leptotrypa clavacoidea. Ulrich, Jour. Cincinnati Soc. Nat. Hist., VI, p. 159.
88. Monticulipora clavacoidea. James and James, Jour. Cincinnati Soc. Nat. Hist., XI, p. 25.
95. Monticulipora clavacoidea. J. F. James, Jour. Cincinnati Soc. Nat. Hist., XVIII, p. 84.

Cincinnati (Lorraine): Cincinnati, Ohio, and vicinity.

trypa ? claviformis Ulrich.

93. Leptotrypa claviformis. Ulrich, Geol. Minnesota, III, p. 319, pl. xxvii, 20, 21.

Trenton (Black River): Minneapolis and St. Paul, Minnesota.

trypa ? clavis Ulrich.

83. Leptotrypa clavis. Ulrich, Jour. Cincinnati Soc. Nat. Hist., VI, p. 161, pl. vi, 3, 3*a*.

Cincinnati (Utica): Cincinnati, Ohio, and vicinity.

trypa ? cortex Ulrich.

83. Leptotrypa cortex. Ulrich, Jour. Cincinnati Soc. Nat. Hist., VI, p. 162.

Cincinnati (Utica): Covington and Newport, Kentucky.

otrypa discoidea Ulrich. See Amplexopora ? discoidea (James).

Leptotrypa ? dychei (James).

1882. Monticulipora (Monotrypa) dychei. James, Paleontologist, No.
1883. Monticulipora dychei. James, Jour. Cincinnati Soc. Nat. Hist., V
pl. x, 2–2*e*.
1888. Monticulipora dychei. James and James, Jour. Cincinnati Soc. Na
XI, p. 25.
1895. Monticulipora dychei. J. F. James, Jour. Cincinnati Soc. Na
XVIII, p. 83.
Cincinnati (Lorraine): Lebanon, Ohio.

Leptotrypa filiosa Ulrich. See Amplexopora filiosa (D'Orbign

Leptotrypa ? hexagonalis Ulrich.

1890. Leptotrypa hexagonalis. Ulrich, Geol. Sur. Illinois, VIII, p.
xxxvi, 6, 6*a*.
1893. Leptotrypa hexagonalis. Ulrich, Geol. Minnesota, III, p. 317.
Trenton (Stones River): Mineral Point, Janesville, and Beloit, W
Calhoun County, Illinois; Minneapolis, Minnesota.

Leptotrypa informis Ulrich.

1893. Leptotrypa informis. Ulrich, Geol. Minnesota, III, p. 317, pl. xxv
Trenton (Stones River): Minneapolis and St. Paul, Minnesota.

Leptotrypa ? irregularis (Ulrich).

1879. Chætetes irregularis. Ulrich, Jour. Cincinnati Soc. Nat. Hist., I
pl. xii, 10–10*b*.
1881. Monticulipora (Monotrypa) irregularis. Nicholson, Genus Monti
p. 177, fig. 35.
1882. Monotrypa irregularis. Ulrich, Jour. Cincinnati Soc. Nat. Hist.,
1888. Monticulipora irregularis. James and James, Jour. Cincinnati
Hist., X, p. 163.
1893. Monticulipora irregularis. J. F. James, Jour. Cincinnati Soc. Na
XV, p. 159.
Cincinnati (Lorraine): Hamilton, Morrow, Mason, and Cincinna

Leptotrypa maculata Ulrich. See Paleschara ? maculata Hall.

Leptotrypa minima Ulrich.

1883. Leptotrypa minima. Ulrich, Jour. Cincinnati Soc. Nat. Hist., V
pl. vi, 2–2*b*.
Cincinnati (Lorraine): Hamilton, Ohio.

Leptotrypa offula Ulrich. See Paleschara ? offula Hall.

Leptotrypa ornata Ulrich.

1883. Leptotrypa ornata. Ulrich, Jour. Cincinnati Soc. Nat. Hist., V
pl. vi, 4, 4*a*.
Cincinnati (Lorraine): Cincinnati, Ohio, and vicinity.

Leptotrypa ? quadrangularis (Nicholson).

1874. Chætetes quadrangularis. Nicholson, Geol. Mag., new ser., I,
iv, 8.
1874. Chætetes quadrangularis. Nicholson, Pal. Province Ontario, p. 6
a, *b*.
1889. Paleschara quadrangularis. Miller, North American Geol. Pal.,
1890. Leptotrypa quadrangularis. Ulrich, Geol. Sur. Illinois, VIII, p. 4
1891. Paleschara quadrangularis. Whiteaves, Contr. Canadian Pal., I,
1892. Leptotrypa quadrangularis. Whiteaves, Contr. Canadian Pal., I,
1883. Paleschara amplectens. Hall, Trans. Albany Institute, X, p. 179 (
1881, p. 179).

rypa ? quadrangularis (Nicholson)—Continued.

4. Paleschara amplectens. Hall, Rep. State Geologist New York for the year 1883, p. 7.

7. Paleschara amplectens. Hall and Simpson, Pal. New York, VI, p. 237.

1. Paleschara amplectens. Hall, Tenth Ann. Rep. State Geologist New York for the year 1890, p. 40; Forty-fourth Ann. Rep. New York State Museum, p. 70.

9. Paleschara amplectens. Grabau, Bull. Buffalo Soc. Nat. Sci., VI, p. 171.

Hamilton: Arkona, Ontario; Seneca Lake, New York (Hall); Hay River, Red Deer River, and near Dawson Bay, Canada (Whiteaves).

rypa ? semipilaris Ulrich.

0. Leptotrypa semipilaris. Ulrich, Geol. Sur. Illinois, VIII, p. 457, pl. xxxvi, 5–5*d*.

4. Leptotrypa semipilaris. J. F. James, Jour. Cincinnati Soc. Nat. Hist., XVI, p. 181.

7. Leptotrypa semipilaris. Simpson, Fourteenth Ann. Rep. State Geologist New York for the year 1894, fig. 148 (not 149, 150=Leptotrypa acervulosa), p. 580.

Cincinnati (Lorraine): Covington, Kentucky; Cincinnati, Ohio.

rypa ? sphærion (Hall).

6. Paleschara ? sphærion. Hall, Twenty-eighth Ann. Rep. New York State Museum (documentary edition), pl. viii, 14, 15.

9. Paleschara ? (Chætetes?) sphærion. Hall, Twenty-eighth Ann. Rep. New York State Museum (Museum edition), p. 121, pl. viii, 14, 15.

2. Paleschara ? (Chætetes ?) sphærion. Hall, Eleventh Ann. Rep. Indiana Geol. Nat. Hist., p. 247, pl. vii, 14, 15.

Niagara: Waldron, Indiana.

rypa stidhami Ulrich.

0. Leptotrypa stidhami. Ulrich, Geol. Sur. Illinois, VIII, p. 456, pl. xxxvi, 4–4*b*.

5. Monticulipora stidhami. J. F. James, Jour. Cincinnati Soc. Nat. Hist., XVIII, p. 76.

Cincinnati (Richmond): Brown County and near Eaton, Ohio; Madison, Indiana.

nalia (not of Hall, 1852), Hall and Simpson, and other authors. Fistulipora McCoy.

ENALIA Hall. Genotype: Lichenalia concentrica Hall.

2. Lichenalia. Hall, Pal. New York, II, p. 171.

Obs. With the Lichenalia concentrica from Lockport, New York, Hall identified a form bearing a superficial resemblance, occurring at Waldron, Indiana; the latter is a species of Fistulipora and entirely different in structure from the Lockport Lichenalia concentrica. In his later work, and in this he has been followed by other authors, Hall used the Waldron form as the type of the genus. Consult the synonymy given under Fistulipora.

nalia alternata Hall. See Fistulipora alternata (Hall).

nalia alveata Hall. See Buskopora bistriata (Hall).

nalia (Odontotrypa) alveata Hall. See Buskopora bistriata (Hall).

nalia bistriata Hall. See Buskopora bistriata (Hall).

nalia bullata Hall. See Fistulipora ? bullata (Hall and Simpson).

Lichenalia ? calycula James. See Aspidopora calycula (James)

Lichenalia carinata Hall. Not recognized.

1883. Lichenalia carinata. Hall, Trans. Albany Institute, X, p. 151 (
1881, p. 9).
Hamilton: Falls of the Ohio.

Lichenalia circincta Hall. See Selenopora circincta (Hall).

Lichenalia (Selenopora) circincta Hall and Simpson. See Sele
circincta (Hall).

Lichenalia clivulata Hall. See Eridopora ? clivulata (Hall).

Lichenalia (Pileotrypa) clivulata Hall. See Eridopora ? clivulata

Lichenalia colliculata Hall. See Fistulipora colliculata (Hall).

Lichenalia (Selenopora) complexa Hall and Simpson. See Sele
complexa (Hall).

Lichenalia complexata Hall. See Selenopora complexa (Hall).

Lichenalia concentrica Hall (in part) and other authors. See
lipora neglecta Rominger.

Lichenalia concentrica Hall.

1852. Lichenalia concentrica. Hall, Pal. New York, II, p. 171, pl. xl E,
Niagara: Lockport, New York.
Obs. See remarks under the genus Lichenalia.

Lichenalia concentrica var. maculata Hall. See Fistulipora n
maculata (Hall).

Lichenalia concentrica var. parvula Hall. See Fistulipor
Rominger.

Lichenalia confusa Hall. See Fistulipora ? confusa (Hall).

Lichenalia constricta Hall. See Fistulipora ? constricta (Hall)

Lichenalia conulata Hall. See Fistulipora ? conulata (Hall).

Lichenalia cornuta Hall. See Fistulipora cornuta (Hall and Si

Lichenalia crassa Hall. See Fistulipora ? crassa (Hall).

Lichenalia (Phractopora) cristata var. lineata Hall. See Phra
cristata Hall.

Lichenalia crustacea Hall. Not recognized.

1883. Lichenalia crustacea. Hall, Trans. Albany Institute, X, p. 150 (
1881, p. 8).
Hamilton: Falls of the Ohio.

Lichenalia cultellata Hall. See Fistulipora cultellata (Hall).

Lichenalia denticulata Hall. See Eridopora denticulata (Hall).

Lichenalia (Pileotrypa) denticulata Hall. See Eridopora den
(Hall).

Lichenalia dissimilis Hall. See Paleschara ? dissimilis (Hall).

Lichenalia distans Hall. See Fistulipora distans (Hall).

Lichenalia distans Hall and Simpson (in error). See Fistulip
tensa (Hall).

Lichenalia distensa Hall. See Fistulipora distensa (Hall).

Lichenalia foliacea Hall. See Fistulipora foliacea (Hall).

enalia geometrica Hall. See Fistulipora geometrica (Hall).

enalia granifera Hall. See Fistulipora ? granifera (Hall).

enalia (Pileotrypa) granifera Hall. See Fistulipora ? granifera
all).

enalia (Ceramopora) imbricella Hall. See Ceramopora ? imbricella
ll.

enalia interaspera Simpson. See Fistulipora interaspera Hall and
npson.

enalia longispina Hall. See Lichenotrypa longispina (Hall).

enalia (Lichenotrypa) longispina Hall and Simpson. See Lichen-
ypa longispina (Hall).

enalia lunata Hall. See Buskopora dentata Ulrich.

enalia lunata var. tubulata Hall. See Buskopora dentata (Ulrich).

enalia maculosa Hall and Simpson. See Fistulipora maculosa
all).

enalia operculata Hall and Simpson. See Pinacotrypa operculata
all and Simpson).

enalia ovata Hall. See Fistulipora ovata (Hall).

enalia paliformis Hall. See Glossotrypa paliformis (Hall).

enalia (Glossotrypa) paliformis Hall. See Glossotrypa paliformis
all).

enalia permarginata Hall. See Fistulipora ? permarginata (Hall).

enalia pustulosa Hall and Simpson. See Fistulipora ? pustulosa
all and Simpson).

enalia pyriformis Hall. See Buskopora pyriformis (Hall).

enalia radiata Hall. Not recognized.

383. Lichenalia radiata. Hall, Trans. Albany Institute, X, p. 152 (abstract, 1881, p. 10).
Upper Helderberg: Onondaga Valley, New York.

enalia ramosa Hall. See Fistulipora ramosa (Hall).

enalia serialis Hall. See Fistulipora serialis (Hall and Simpson).

enalia stellata Hall. See Pinacotrypa stellata (Hall).

enalia subcava Hall. See Fistulipora subcava (Hall).

enalia substellata Hall. See Fistulipora substellata (Hall).

enalia subtrigona Hall. See Fistulipora subtrigona (Hall).

enalia tessellata Hall and Simpson. See Favicella tessellata (Hall
d Simpson).

enalia torta Hall. See Fistulipora torta (Hall) and Fistulipora
ialis (Hall).

enalia tortuosa (in error for torta) Hall. See Fistulipora serialis
all).

enalia vesiculata Hall and Simpson. See Fistulipora vesiculata
all).

ENOTRYPA Ulrich. Genotype: Lichenotrypa cavernosa Ulrich =
chenotrypa longispina (Hall).

386. Lichenotrypa. Ulrich, Contr. American Pal., I, p. 23.

LICHENOTRYPA Ulrich—Continued.

1887. Lichenotrypa. Hall and Simpson, Pal. New York, VI, p. xvii.
1889. Lichenotrypa. Miller, North American Geol. Pal., p. 312.
1890. Lichenotrypa. Ulrich, Geol. Sur. Illinois, VIII, p. 383.
1896. Lichenotrypa. Ulrich, Zittel's Textb. Pal. (Engl. ed.), p. 270.
1897. Lichenotrypa. Simpson, Fourteenth Ann. Rep. State Geologist Ne
for the year 1894, p. 556.

Lichenotrypa aspera (in error for cavernosa) Ulrich. See Li
trypa longispina (Hall).

Lichenotrypa cavernosa Ulrich. See Lichenotrypa longispina

Lichenotrypa longispina (Hall).

1883. Lichenalia longispina. Hall, Trans. Albany Institute, X, p. 153 (
1881, p. 11).
1886. Lichenotrypa longispina. Hall, Fifth Ann. Rep. State Geologist N
for the year 1885, pl. xxv, 11, 12.
1887. Lichenalia (Lichenotrypa) longispina. Hall and Simpson, Pal. Ne
VI, p. 287, pl. xxv, 11, 12.
1897. Lichenotrypa longispina. Simpson, Fourteenth Ann. Rep. State
New York for the year 1894, pl. xxiii, 7.
1886. Lichenotrypa cavernosa. Ulrich, Contr. American Pal., I, p. 24
(In explanation of plate ii called Lichenotrypa aspera in error.)
Hamilton: Falls of the Ohio.

Limaria Steininger. Not a bryozoan genus.

Limaria falcata Prout. Probably a bryozoan, but not recogniz

1859. Limaria falcata. Prout, Trans. St. Louis Acad. Sci., I, p. 446, pl. x
Devonian: Falls of the Ohio.

LIOCLEMA Ulrich. Genotype: Callopora punctata Hall.

1882. Leioclema. Ulrich, Jour. Cincinnati Soc. Nat. Hist., V, pp. 141, 15
1889. Leioclema. Miller, North American Geol. Pal., p. 310.
1890. Leioclema. Ulrich, Geol. Sur. Illinois, VIII, pp. 376, 425.

Lioclema ? araneum Ulrich.

1890. Leioclema ? araneum. Ulrich, Geol. Sur. Illinois, VIII, p. 431,
9–9*c*.
1894. Leioclema araneum. Keyes, Missouri Geol. Sur., V, p. 14.
Chester: Chester, and Monroe County, Illinois; Pulaski and Jacks
ties, Kentucky.

Lioclema asperum (Hall).

1852. Callopora aspera. Hall, Pal. New York, II, p. 147, pl. xl, 4*a–i*.
1890. Leioclema asperum. Ulrich, Geol. Sur. Illinois, VIII, pp. 416, 425.
Niagara: Lockport, New York.

Lioclema cellulosum (Hall).

1879. Callopora cellulosa. Hall, Thirty-second Ann. Rep. New Yor
Museum, p. 154 (reprint, 1880, p. 16).
1883. Callopora cellulosa. Hall, Rep. State Geologist New York for
1882, pl. xii, 7–9, pl. xiii, 9.
1887. Callopora cellulosa. Hall and Simpson, Pal. New York, VI, p. 2
1–9, pl. xiii, 9, pl. xxiii A, 6.
1890. Leioclema cellulosum. Ulrich, Geol. Sur. Illinois, VIII, p. 425.
1879. Callopora fistulosa. Hall, Thirty-second Ann. Rep. New Yor
Museum, p. 154 (reprint, 1880, p. 16).

na cellulosum (Hall)—Continued.

3. Callopora fistulosa. Hall, Rep. State Geologist New York for the year 1882, pl. xii, 1–6.
Lower Helderberg: Clarksville, New York.

na confertiporum (Hall).

3. Thallostigma confertipora. Hall, Trans. Albany Institute, X, p. 184 (abstract, 1881, p. 184).
4. Thallostigma confertipora. Hall, Rep. State Geologist New York for the year 1883, p. 19.
7. Fistulipora confertipora. Hall and Simpson, Pal. New York, VI, p. 211, pl. lviii, 1–5.
7. Fistuliporina confertipora. Simpson, Fourteenth Ann. Rep. State Geologist New York for the year 1894, pl. xxi, 13.
Hamilton: Moscow, New York.
Obs. See note on Lioclema minutum (Rominger).

na decipiens (Hall).

3. Thallostigma decipiens. Hall, Trans. Albany Institute, X, p. 187 (abstract, 1881, p. 187).
4. Thallostigma decipiens. Hall, Rep. State Geologist New York for the year 1883, p. 29.
7. Fistulipora decipiens. Hall and Simpson, Pal. New York, VI, p. 232, pl. lix, 9.
Hamilton: York, New York.
Obs. See note on Lioclema minutum (Rominger).

na densum (Hall).

3. Thallostigma densa. Hall, Trans. Albany Institute, X, p. 186 (abstract, 1881, p. 186).
4. Thallostigma densa. Hall, Rep. State Geologist New York for the year 1883, p. 25.
7. Fistulipora densa. Hall and Simpson, Pal. New York, VI, p. 231.
Hamilton: York, New York.
Obs. See note on Lioclema minutum (Rominger).

na digitatum (Hall).

3. Thallostigma digitata. Hall, Trans. Albany Institute, X, p. 185 (abstract, 1881, p. 185).
4. Thallostigma digitata. Hall, Rep. State Geologist New York for the year 1883, p. 24.
7. Fistulipora digitata. Hall and Simpson, Pal. New York, VI, p. 229, pl. lix, 12, 13.
7. Fistuliporina digitata. Simpson, Fourteenth Ann. Rep. State Geologist New York for the year 1894, pl. xxi, 11.
9. Fistuliporina digitata. Grabau, Bull. Buffalo Soc. Nat. Sci., VI, p. 170, fig. 65.
Hamilton: Hamburg, Erie County, New York.
Obs. See note on Lioclema minutum (Rominger).

na ? exsul (Hall).

6. Alveolites exsul. Hall, Twenty-eighth Ann. Rep. New York State Museum (documentary edition), pl. ix, 3, 4.
9. Callopora exsul. Hall, Twenty-eighth Ann. Rep. New York State Museum (Museum edition), p. 115, pl. ix, 3, 4.
2. Callopora exsul. Hall, Eleventh Ann. Rep. Indiana Geol. Nat. Hist., p. 238, pl. viii, 3, 4.
9. Callopora ? exsul. Miller, North American Geol. Pal., fig. 463 (p. 295).
Niagara: Waldron, Indiana.

Lioclema (? Nicholsonella) floridum (Hall).

1852. Callopora florida. Hall, Pal. New York, II, p. 146, pl. xl, 2*a–f*.
1890. Leioclema florida. Ulrich, Geol. Sur. Illinois, VIII, pp. 416, 425.
Niagara: Lockport, New York.

Lioclema foliatum Ulrich.

1889. Leioclema foliatum. (Ulrich, in press), Miller, North American
fig. 491 (p. 311).
1890. Leioclema foliatum. Ulrich, Geol. Sur. Illinois, VIII, p. 431, fig.
1894. Leioclema foliatum. Keyes, Missouri Geol. Sur., V, p. 14.
1896. Lioclema foliata. Ulrich, Zittel's Textb. Pal. (Engl. ed.), fig. 465
Warsaw: Warsaw, Illinois.

Lioclema gracillimum Ulrich.

1888. Leioclema gracillimum. Ulrich, Bull. Denison Univ., IV, p.
described.)
1890. Leioclema gracillimum. Ulrich, Geol. Sur. Illinois, VIII, p. 429
6–6*b*.
1894. Leioclema gracillimum. Keyes, Missouri Geol. Sur., V, p. 13.
Kinderhook: Marshalltown, Iowa.
Burlington: Burlington, Iowa.
Keokuk: Keokuk, Iowa, and other localities.
Warsaw: Warsaw, Illinois.
Waverly: Lodi, Ohio.

Lioclema intercellatum (Hall).

1883. Thallostigma intercellata. Hall, Trans. Albany Institute,
(abstract, 1881, p. 13).
1886. Fistulipora intercellata. Hall, Fifth Ann. Rep. State Geologist
for the year 1885, pl. xxxii, 15–20.
1887. Fistulipora intercellata. Hall and Simpson, Pal. New York, VI
xxxii, 15–20.
Hamilton: Falls of the Ohio.
Obs. See note on Lioclema minutum (Rominger).

Lioclema involvens (Hall and Simpson).

1887. Fistulipora involvens. Hall and Simpson, Pal. New York,
pl. lix, 2.
Hamilton: Near Alden Station, New York.
Obs. See note on Lioclema minutum (Rominger).

Lioclema (? Nicholsonella) laminatum (Hall).

1852. Callopora laminata. Hall, Pal. New York, II, p. 146, pl. xl, 3*a–e*.
1890. Leioclema ? laminatum. Ulrich, Geol. Sur. Illinois, VIII, pp. 416
Niagara: Lockport, New York.

Lioclema microporum (Hall).

1883. Thallostigma micropora. Hall, Trans. Albany Institute, X, p. 186
1881, p. 186).
1884. Thallostigma micropora. Hall, Rep. State Geologist New Yor
year 1883, p. 26.
1887. Fistulipora micropora. Hall and Simpson, Pal. New York, VI,
lvii, 20, pl. lix, 3.
1897. Fistuliporina micropora. Simpson, Fourteenth Ann. Rep. State
New York for the year 1894, pl. xxi, 6–8.
1899. Fistuliporina micropora. Grabau, Bull. Buffalo Soc. Nat. Sci.,
fig. 63.
Hamilton: Eighteenmile Creek, Erie County, New York.
Obs. See note on Lioclema minutum (Rominger).

clema minutissimum (Nicholson).

1875. Callopora minutissima. Nicholson, Pal. Province Ontario, p. 77, fig. 43.
1898. Leioclema minutissimum. Whiteaves, Contr. Canadian Pal., I, p. 380.
Hamilton: Arkona, Ontario.
Obs. See note on Lioclema minutum (Rominger).

clema minutum (Rominger).

1866. Fistulipora minuta. Rominger, Proc. Acad. Nat. Sci. Philadelphia, p. 120.
1887. Fistulipora minuta (?). Hall and Simpson, Pal. New York, VI, p. 223, pl. lix, 5–8.
1890. Leioclema minutum. Ulrich, Geol. Sur. Illinois, VIII, p. 427.
1899. Fistuliporina minuta. Grabau, Bull. Buffalo Soc. Nat. Sci., VI, p. 169, fig. 64.
1883. Thallostigma striata. Hall, Trans. Albany Institute, X, p. 186 (abstract, 1881, p. 186).
1884. Thallostigma striata. Hall, Rep. State Geologist New York for the year 1884, p. 28.
Hamilton: Near Alpena, Michigan; Buffalo and Davenport, Iowa; Andalusia and Rock Island, Illinois; Erie County, Delphi, and West Hamburg, New York.
Obs. We believe the following species to be closely related to, if not identical with, this species: Lioclema confertiporum, decipiens, digitatum, intercellatum, involvens, microporum, minutissimum, multaculeatum, punctillatum, segregatum, and subtile. However, before they are placed as actual synonyms, the types, if accessible, or specimens from the typical localities, must be studied.

clema multaculeatum (Hall).

1884. Thallostigma multaculeata. Hall, Rep. State Geologist New York for the year 1883, p. 23.
1887. Fistulipora multaculeata. Hall and Simpson, Pal. New York, VI, p. 228, pl. lix, 10, 11.
1897. Fistuliporina multiculeata. Simpson, Fourteenth Ann. Rep. State Geologist New York for the year 1894, pl. xxi, 12.
Hamilton: Darien Center, New York.
Obs. See note on Lioclema minutum (Rominger).

clema occidens (Hall and Whitfield).

1873. Fistulipora occidens. Hall and Whitfield, Twenty-third Ann. Rep. New York State Museum, p. 228, pl. x, 9, 10.
1890. Leioclema occidens. Ulrich, Geol. Sur. Illinois, VIII, p. 426.
1878. Callopora cincinnatiensis. Ulrich, Jour. Cincinnati Soc. Nat. Hist., I, p. 93, pl. iv, 8, 8*a*.
1882. Callopora cincinnatiensis. Ulrich, Jour. Cincinnati Soc. Nat. Hist., V, p. 142, pl. vi, 18, 18*a*.
Hamilton: Hackberry, Rockford, Independence, and Buffalo, Iowa; Rock Island, Illinois; Calloway County, Missouri.

clema parasiticum (Hall).

1879. Callopora parasitica (in part). Hall, Thirty-second Ann. Rep. New York State Museum, p. 157 (reprint, 1880, p. 19).
1883. Callopora parasitica. Hall, Rep. State Geologist New York for the year 1882, pl. xiv, 13–18.
1887. Fistulipora parasitica. Hall and Simpson, Pal. New York, VI, p. 28, pl. xiv, 13, 14, pl. xxiii, 4.

Lioclema parasiticum (Hall)—Continued.

1890. Leioclema parasiticum. Ulrich, Geol. Sur. Illinois, VIII, p. 425.
Lower Helderberg: Clarksville, New York.

Lioclema ponderosum (Hall).

1874. Callopora ponderosa. Hall, Twenty-sixth Ann. Rep. New York State Museum, p. 103.
1879. Callopora ponderosa. Hall, Thirty-second Ann. Rep. New York State Museum, p. 156 (reprint, 1880, p. 18).
1883. Callopora ponderosa. Hall, Rep. State Geologist New York for the year 1882, pl. xiv, 9–12.
1887. Fistulipora ponderosa. Hall and Simpson, Pal. New York, VI, p. 27, pl. xiv, 9–12, pl. xxiiiA, 8–10.
1890. Leioclema ponderosum. Ulrich, Geol. Sur. Illinois, VIII, p. 425.
1897. Fistuliporina ponderosa. Simpson, Fourteenth Ann. Rep. State Geologist New York for the year 1894, pl. xxi, 14.
Lower Helderberg: Schoharie, New York.

Lioclema punctatum (Hall).

1858. Callopora punctata. Hall, Geol. Iowa, I, Part 2, p. 653.
1882. Leioclema punctata. Ulrich, Jour. Cincinnati Soc. Nat. Hist., V, p. 141, pl. vi, 1, 1*a*.
1888. Leioclema punctatum. Ulrich, Bull. Denison Univ., IV, p. 91.
1890. Leioclema punctatum. Ulrich, Geol. Sur. Illinois, VIII, p. 430.
1894. Leioclema punctatum. Keyes, Missouri Geol. Sur., V, p. 13.
1866. Callopora missouriensis. Rominger, Proc. Acad. Nat. Sci. Philadelphia, p. 117.
Keokuk: Keokuk, Iowa; Kings Mountain, Kentucky; Lagrange, Missouri.
Warsaw: Warsaw and Columbia, Illinois.
Waverly: Cuyahoga Valley, Ohio.

Lioclema punctillatum (Winchell).

1866. Callopora punctillata. Winchell, Rep. Lower Peninsula Michigan, p. 88.
Hamilton: Petoskey, Michigan.
Obs. See note on Lioclema minutum (Rominger).

Lioclema segregatum (Hall).

1883. Thallostigma segregata. Hall, Trans. Albany Institute, X, p. 186 (abstract, 1881, p. 186).
1884. Thallostigma segregata. Hall, Rep. State Geologist New York for the year 1883, p. 27.
1887. Fistulipora segregata. Hall and Simpson, Pal. New York, VI, p. 219, pl. lix, 4.
1899. Fistuliporina segregata. Grabau, Bull. Buffalo Soc. Nat. Sci., VI, p. 168, fig. 62.
Hamilton: Eighteenmile Creek, New York.
Obs. See note on Lioclema minutum (Rominger).

Lioclema spheroideum (Hall).

1883. Thallostigma spheroidea. Hall, Trans. Albany Institute, X, p. 187 (abstract, 1881, p. 187).
1884. Thallostigma spheroidea. Hall, Rep. State Geologist New York for the year 1883, p. 31.
1887. Fistulipora spheroidea. Hall and Simpson, Pal. New York, VI, p. 225, pl. lvii, 3, 4.
Hamilton: York, New York.

ioclema subglobosum Ulrich.

1890. Leioclema subglobosum. Ulrich, Geol. Sur. Illinois, VIII, p. 428, pl. lxxv, 8–8*b*.
Kinderhook: Marshalltown, Iowa.

ioclema subtile (Hall).

1883. Thallostigma subtilis. Hall, Trans. Albany Institute, X, p. 187 (abstract, 1881, p. 187).
1884. Thallostigma subtilis. Hall, Rep. State Geologist New York for the year 1883, p. 30.
1887. Fistulipora ? subtilis. Hall and Simpson, Pal. New York, VI, p. 233.
1898. Fistulipora ? subtilis. Whiteaves, Contr. Canadian Pal., I, p. 380.
Hamilton: West Williams, Ontario.
Obs. See note on Lioclema minutum (Rominger).

ioclema wachsmuthi Ulrich.

1890. Leioclema wachsmuthi Ulrich. Geol. Sur. Illinois, VIII, p. 428, pl. lxxv, 7–7*b*.
Kinderhook: Marshalltown, Iowa.

ioclema ? wilmingtonense Ulrich.

1890. Leioclema wilmingtonense. Ulrich, Geol. Sur. Illinois, VIII, p. 426, pl. xxxiv, 4–4*b*.
1895. Monticulipora wilmingtonense. J. F. James, Jour. Cincinnati Soc. Nat. Hist., XVIII, p. 76.
Cincinnati (Richmond): Wilmington, Illinois.

IOCLEMELLA Foerste. Genotype: Callopora ohioensis Foerste.

1895. Lioclemella. Foerste, Geol. Sur. Ohio, VII, p. 600.

ioclemella annulifera (Whitfield).

1878. Trematopora annulifer. Whitfield, Ann. Rep. Geol. Sur. Wisconsin for the year 1877, p. 67.
1882. Trematopora annulifer. Whitfield, Geol. Sur. Wisconsin, IV, p. 254, pl. xi, 15–17.
1882. Batostomella annulifera. Ulrich, Jour. Cincinnati Soc. Nat Hist., V, p. 141.
1895. Lioclemella annulifera. (Ulrich) Foerste, Geol. Sur. Ohio, VII, p. 600.
Cincinnati (Richmond): Delafield and Iron Ridge, Wisconsin; Eaton, Ohio.

oclemella fusiformis (Whitfield).

1878. Chætetes fusiformis. Whitfield, Ann. Rep. Geol. Sur. Wisconsin for the year 1877, p. 70.
1882. Chætetes fusiformis. Whitfield, Geol. Sur. Wisconsin, IV, p. 248, pl. xi, 13, 14.
1895. Lioclemella fusiformis. (Ulrich) Foerste, Geol. Sur. Ohio, VII, p. 600.
Cincinnati (Richmond): Iron Ridge, Wisconsin.

oclemella nitida (Ulrich).

1890. Trematopora ? nitida. Ulrich, Geol. Sur. Illinois, VIII, p. 419, pl. xxxiv, 2–2*f*.
1895. Lioclemella nitida. (Ulrich) Foerste, Geol. Sur. Ohio, VII, p. 600.
Cincinnati (Richmond): Savannah, Illinois.

oclemella ohioensis (Foerste).

1887. Callopora ohioensis. Foerste, Bull. Sci. Lab. Denison Univ., II, p. 174; ibid., III, 1888, pl. xvi, 6.
1895. Lioclemella ohioensis. Foerste, Geol. Sur. Ohio VII, p. 600, pl. xxix, 6.
Clinton: Dayton and Centerville, Ohio.

Lioclemella solidissima (Whitfield).

1878. Fistulipora solidissima. Whitfield, Ann. Rep. Geol. Sur. Wisconsin for the year 1877, p. 69.

1882. Fistulipora solidissima. Whitfield, Geol. Sur. Wisconsin, IV, p. 255, pl. xi, 18, 19.

Cincinnati (Richmond): Delafield and Iron Ridge, Wisconsin; Savannah, Illinois.

Lioclemella subfusiformis (James).

1882. Monticulipora (? Monotrypa) subfusiformis. James, Paleontologist, No. 6, p. 52; ibid., No. 7, 1883, pl. i, 1.

1888. Monticulipora fusiformis (not of Whitfield). James and James, Jour. Cincinnati Soc. Nat. Hist., XI, p. 26.

1895. Monticulipora fusiformis, (not of Whitfield). J. F. James, Jour. Cincinnati Soc. Nat. Hist., XVIII, p. 83.

Cincinnati (Richmond): Warren and Clinton counties, Ohio.

LOCULIPORA Hall. Genotype: Fenestella perforata Hall.

1885. Loculipora. Hall, Rep. State Geologist New York for the year 1884, p. 37.

1887. Loculipora. Hall and Simpson, Pal. New York, VI, p. xxiii.

1889. Loculipora. Miller, North American Geol. Pal., p. 312.

1895. Loculipora. Simpson, Thirteenth Ann. Rep. State Geologist New York for the year 1893, pp. 690, 716, 726; Forty-seventh Ann. Rep. New York State Museum, pp. 884, 910, 920.

1897. Loculipora. Simpson, Fourteenth Ann. Rep. State Geologist New York for the year 1894, pp. 511, 520.

1899. Loculipora. Grabau, Bull. Buffalo Soc. Nat. Sci., VI, p. 160.

1888. Tectulipora. Hall, Seventh Ann. Rep. State Geologist New York for the year 1887, [p. 395]; Forty-first Ann. Rep. New York State Museum, [p. 395]. (Not defined).

1895. Tectulipora. Simpson, Thirteenth Ann. Rep. State Geologist New York for the year 1893, pp. 690, 715, 726; Forty-seventh Ann. Rep. New York State Museum, pp. 884, 909, 920.

1897. Tectulipora. Simpson, Fourteenth Ann. Rep. State Geologist New York for the year 1894, pp. 511, 520.

Obs. Sections of Loculipora perforata show that the nonporiferous dissepiments are reduced to a minimum, the branches coming close together (anastomosing); but it is not correct to say that the dissepiments are celluliferous. The structure is in all essential respects precisely as in the species loculata, the type of Tectulipora.

Loculipora ambigua (Hall).

1876. Hemitrypa dubia. Hall, Twenty-eighth Ann. Rep. New York State Museum (documentary edition), pl. xi, 17–21.

1879. Fenestella ambigua. Hall, Twenty-eighth Ann. Rep. New York State Museum (Museum edition), p. 123, pl. xi, 17–21.

1882. Fenestella ambigua. Hall, Eleventh Ann. Rep. Indiana Geol. Nat. Hist., p. 248, pl. xi, 17–21.

1889. Loculipora ambigua. Miller, North American Geol. Pal., p. 312.

1890. Isotrypa ambigua. Ulrich, Geol. Sur. Illinois, VIII, p. 534.

Niagara: Waldron, Indiana.

Loculipora circumstata (Hall and Simpson).

1887. Fenestella (Loculipora) circumstata. Hall and Simpson, Pal. New York, VI, p. 144, pl. liv, 22–25.

Upper Helderberg: Walpole, Ontario.

culipora circumstata (Hall and Simpson)—Continued.

Obs. This form and that described as Loculipora perforata may prove to be the same species.

culipora loculata (Hall).

1888. Fenestella (Tectulipora) loculata. Hall, Seventh Ann. Rep. State Geologist New York for the year 1887 [p. 395]; Forty-first Ann. Rep. New York State Museum [p. 395].

1897. Tectulipora loculata. Simpson, Fourteenth Ann. Rep. State Geologist New York for the year 1894, figs. 60, 61 (p. 511), pl. vii, 1–5 (called Tectulipora biperforata on the explanation sheet).

1888. Fenestella parallela. Hall, Seventh Ann. Rep. State Geologist New York for the year 1887, pl. ix, 6–11; Forty-first Ann. Rep. New York State Museum, pl. ix, 6–11.

Lower Helderberg: Clarksville, New York.

culipora perforata (Hall).

1884. Fenestella perforata. Hall, Thirty-sixth Ann. Rep. New York State Museum, p. 65.

1885. Loculipora perforata. Hall, Rep. State Geologist New York for the year 1884, pl. ii, 15.

1887. Fenestella (Loculipora) perforata. Hall, Sixth Ann. Rep. State Geologist New York for the year 1886, p. 62.

1888. Fenestella (Loculipora) perforata. Hall, Seventh Ann. Rep. State Geologist New York for the year 1887, pl. x, 1–13; Forty-first Ann. Rep. New York State Museum, pl. x, 1–13.

1897. Loculipora perforata. Simpson, Fourteenth Ann. Rep. State Geologist New York for the year 1894, pl. vii, 6–12.

1899. Loculipora perforata. Grabau, Bull. Buffalo Soc. Nat. Sci., VI, p. 160, fig. 49.

Hamilton: Darien and near Canandaigua Lake, New York.

YROPORA Hall. Genotype: Fenestella (Lyropora) subquadrans Hall.

1857. Lyropora. Hall, Proc. American Assoc. Adv. Sci., X, p. 179.

1882. Lyropora. Ulrich, Jour. Cincinnati Soc. Nat. Hist., V, p. 150.

1883. Lyropora. Claypole, Quar. Jour. Geol. Soc. London, XXXIX, p. 32.

1885. Lyropora. Hall, Rep. State Geologist New York for the year 1884, p. 37.

1885. Lyropora. Waagen and Pichl, Pal. Indica, Ser. XIII, p. 773.

1886. Lyropora. Ulrich, Contr. American Pal., I, p. 5.

1889. Lyropora. Miller, North American Geol. Pal., p. 312.

1890. Lyropora. Ulrich, Geol. Sur. Illinois, VIII, pp. 396, 580.

1895. Lyropora. Simpson, Thirteenth Ann. Rep. State Geologist New York for the year 1893, pp. 689, 723, 726; Forty-seventh Ann. Rep. New York State Museum, pp. 883, 917, 920.

1896. Lyropora. Ulrich, Zittel's Textb. Pal. (Engl. ed.), p. 282.

1897. Lyropora. Simpson, Fourteenth Ann. Rep. State Geologist New York for the year 1894, pp. 515, 522.

1895. Lyroporella. Simpson, Thirteenth Ann. Rep. State Geologist New York for the year 1893, pp. 701, 724, 727; Forty-seventh Ann. Rep. New York State Museum, pp. 895, 918, 921.

1897. Lyroporella. Simpson, Fourteenth Ann. Rep. State Geologist New York for the year 1894, pp. 516, 522.

1895. Lyroporina. Simpson, Thirteenth Ann. Rep. State Geologist New York for the year 1893, pp. 723, 727; Forty-seventh Ann. Rep. New York State Museum, pp. 917, 921.

LYROPORA Hall—Continued.

1897. Lyroporina. Simpson, Fourteenth Ann. Rep. State Geologist New York for the year 1894, p. 522.

1897. Lyroporidra. Simpson, Fourteenth Ann. Rep. State Geologist New York for the year 1894, pp. 517, 522.

Obs. On page 701 of the Thirteenth Ann. Rep. State Geologist New York for the year 1893 Simpson proposes the name Lyroporella for species of Lyropora having but two ranges of cells on a branch throughout. On page 723 of the same work the name Lyroporina is proposed for the same group. No genotype is mentioned, nor do we know of any species having but two ranges of cells. This group is therefore apparently imaginary, and should strictly not have been placed above as a synonym of Lyropora. On page 724 a new genus Lyroporella is made for forms having two ranges of cells on the narrower portion of the branches and three or more on the wider portion.

In the Fourteenth Annual Report of the State Geologist of New York for the year 1894 Lyroporella is held for the two and three ranged forms, Lyroporina for the two ranged, and a new genus Lyroporidra is added. Six species and one variety of Lyropora have been described, and we know of no new forms. These species show that the only constant generic character is the thickened V or U shaped calcareous support. This at once shows the utter uselessness of Simpson's proposed names. The same carelessness and artificiality are exhibited in other cases. See synonymy under Ptiloporella, Ptiloporina, Fenestella, Polypora, etc.

Lyropora cinctura Hall. See Reteporidra cinctuta (Hall).

Lyropora divergens Ulrich.

1890. Lyropora divergens. Ulrich, Geol. Sur. Illinois, VIII, p. 584, pl. lviii, 4–4*b*, 4*d*.

1894. Lyropora divergens. Keyes, Missouri Geol. Sur., V, p. 28.

Chester: Chester, Illinois; Sloans Valley, Kentucky.

Lyropora ovalis Ulrich.

1890. Lyropora ovalis. Ulrich, Geol. Sur. Illinois, VIII, p. 585, pl. lviii, 5–5*b*; pl. lv, 8.

Chester: Grayson Springs and Litchfield, Kentucky.

Lyropora quincuncialis (Hall).

1857. Fenestella (Lyropora) quincuncialis. Hall, Proc. American Assoc. Adv. Sci., X, p. 180.

1890. Lyropora quincuncialis. Ulrich, Geol. Sur. Illinois, VIII, p. 583, pl. lviii, 3–3*d*, pl. lv, 7–7*c*.

1894. Lyropora quincuncialis. Keyes, Missouri Geol. Sur., V, p. 27.

1897. Lyroporella quincuncialis. Simpson, Fourteenth Ann. Rep. State Geologist New York for the year 1894, fig. 69 (p. 516).

Chester: Chester, Illinois; Sloans Valley, Kentucky.

Lyropora ranosculum Ulrich.

1890. Lyropora ranosculum. Ulrich, Geol. Sur. Illinois, VIII, p. 581, pl. lviii, 1–1*c*.

1897. Lyropora ranosculum. Simpson, Fourteenth Ann. Rep. State Geologist New York for the year 1894, figs. 66–68 (p. 515).

Chester: Chester and Kaskaskia, Illinois; Sloans Valley, Kentucky.

Lyropora retrorsa (Meek and Worthen).

1868. Fenestella (Lyropora) retrorsa. Meek and Worthen, Geol. Sur. Illinois, III, p. 504, pl. xv, 1.

yropora retrorsa (Meek and Worthen)—Continued.
1894. Lyropora retrorsa. Keyes, Missouri Geol. Sur., V, p. 27, pl. xxxiv, 4.
Burlington: Burlington, Iowa.

yropora subquadrans (Hall).
1857. Fenestella (Lyropora) subquadrans. Hall, Proc. American Assoc. Adv. Sci., X, p. 180.
1890. Lyropora subquadrans. Ulrich, Geol. Sur. Illinois, VIII, p. 582, pl. lviii, 2–2*e*.
1894. Lyropora subquadrans. Keyes, Missouri Geol. Sur., V, p. 27.
1897. Lyroporidra subquadrans. Simpson, Fourteenth Ann. Rep. State Geologist New York for the year 1894, pl. ix, 19.
Chester: Chester, Illinois; Sloans Valley, Kentucky.

yropora subquadrans-lyra (Hall).
1857. Fenestella (Lyropora) lyra. Hall, Proc. American Assoc. Adv. Sci., X, p. 179.
1890. Lyropora subquadrans var. lyra. Ulrich, Geol. Sur. Illinois, VIII, p. 583.
Chester: Kaskaskia and Chester, Illinois.

yroporella Simpson. See Lyropora Hall.

yroporella quincuncialis Simpson. See Lyropora quincuncialis (Hall).

yroporidra Simpson. See Lyropora Hall.

yroporidra subquadrans Simpson. See Lyropora subquadrans (Hall).

yroporina Simpson. See Lyropora Hall.

EEKOPORA Ulrich. Genotype: Meekopora eximia Ulrich.
1890. Meekopora. Ulrich, Geol. Sur. Illinois, VIII, pp. 383, 482.
1889. Meekopora. (Ulrich, in press), Miller, North American Geol. Pal., p. 312.
1896. Meekopora. Ulrich, Zittel's Textb. Pal. (Engl. ed.), p. 270.
1897. Meekapora. Simpson, Fourteenth Ann. Rep. State Geologist New York for the year 1894, p. 538.

eekopora ? aperta Ulrich.
1890. Meekopora ? aperta. Ulrich, Geol. Sur. Illinois, VIII, p. 485, pl. lxxvi, 1, 1*a*.
Keokuk: Kings Mountain, Kentucky.

eekopora approximata Ulrich.
1890. Meekopora approximata. Ulrich, Geol. Sur. Illinois, VIII, p. 484, pl. lxxvii, 5.
1894. Meekopora approximata. Keyes, Missouri Geol. Sur., V, p. 16.
Chester: Chester, Illinois; Sloans Valley, Kentucky.

eekopora clausa (Ulrich).
1884. Fistulipora ? clausa. Ulrich, Jour. Cincinnati Soc. Nat. Hist., VII, p. 47, pl. iii, 4–4*b*.
1889. Meekopora clausa. Miller, North American Geol. Pal., fig. 494 (p. 313).
1890. Meekopora clausa. Ulrich, Geol. Sur. Illinois, VIII, p. 485, pl. lxxvi, 6, pl. lxxvii, 7–7*b*, fig. 5*e* (p. 315).
1894. Meekopora clausa. Keyes, Missouri Geol. Sur., V, p. 17.
1897. Meekapora clausa. Simpson, Fourteenth Ann. Rep. State Geologist New York for the year 1894, fig. 94 (in part) (p. 538).
Chester: Sloans Valley and Grayson Springs, Kentucky; Chester, Illinois.

eekopora eximia Ulrich.
1890. Meekopora eximia. Ulrich, Geol. Sur. Illinois, VIII, p. 483, pl. lxxvii, 6–6*d*.

Meekopora eximia Ulrich—Continued.

1896. Meekopora eximia. Ulrich, Zittel's Textb. Pal. (Engl. (p. 270).

1897. Meekopora eximia. Simpson, Fourteenth Ann. Rep. State York for the year 1894, fig. 94 (in part) (p. 538).

Ste. Genevieve: Pella, Iowa.

Chester: Monroe County, Illinois; Caldwell County, Kent

Meekopora foliacea (Hall).

1852. Ceramopora foliacea. Hall, Pal. New York, II, p. 170, pl. x

Niagara: Lockport, New York.

Meekopora stellifera (Rominger).

1866. Fistulipora stellifera. Rominger, Proc. Acad. Nat. Sci. Phila

1890. Fistulipora stellifera. Ulrich, Geol. Sur. Illinois, VIII, p 2, 2*a*.

Hamilton: Near Alpena, Michigan.

MESOTRYPA Ulrich. Genotype: Diplotrypa infida Ulric

1879. Diplotrypa (in part). Nicholson, Paleozoic Tabulate Cora

1881. Diplotrypa (in part). Nicholson, Genus Monticulipora, p

1882. Diplotrypa (in part). Ulrich, Jour. Cincinnati Soc. Nat. H

1883. Diplotrypa (in part). Foord, Contr. Micro-Pal. Cambro-Si

1890. Diplotrypa (in part). Ulrich, Geol. Sur. Illinois, VIII, p.

1893. Mesotrypa. Ulrich, Geol. Minnesota, III, p. 257.

Mesotrypa discoidea Ulrich.

1893. Mesotrypa discoidea. Ulrich, Geol. Minnesota, III, p. 260

Trenton: Goodhue County, Minnesota.

Mesotrypa infida (Ulrich).

1886. Diplotrypa infida. Ulrich, Fourteenth Ann. Rep. Geol. Minnesota, p. 88.

1893. Mesotrypa infida. Ulrich, Geol. Minnesota, III, p. 258, pl.

1896. Mesotrypa infida. Ulrich, Zittel's Textb. Pal. (Engl. ed 273).

Trenton (Black River): Minneapolis, St. Paul, and Goodhu counties, Minnesota.

Mesotrypa milleri (Ulrich).

1882. Diplotrypa milleri. Ulrich, Jour. Cincinnati Soc. Nat. pl. xi, 2–2*c*.

Niagara: Osgood, Indiana.

Mesotrypa patella (Ulrich).

1890. Diplotrypa patella. Ulrich, Geol. Surv. Illinois, VIII, p. 2–2*c*.

1893. Mesotrypa patella. Ulrich, Geol. Minnesota, III, p. 257.

1894. Diplotrypa patella. J. F. James, Jour. Cincinnati Soc. N p. 184.

Cincinnati (Richmond): Oxford, Ohio; Richmond, Indiana

Mesotrypa quebecensis (Ami).

1892. Diplotrypa Quebecensis. Ami, Canadian Record of Scienc

1893. Mesotrypa quebecensis. Ulrich, Geol. Minnesota, III, p. 25

Trenton: Quebec City, Quebec; Bridport, Vermont; Tre Little Falls, New York; Frankfort, Burgin, and Danv Decorah, Iowa.

esotrypa regularis (Foord).

1883. Diplotrypa regularis. Foord, Contr. Micro-Pal. Cambro-Sil., p. 13, pl. i, 3–3*c*.
1893. Mesotrypa regularis. Ulrich, Geol. Minnesota, III, p. 257.
Trenton: Ottawa City, Canada.

esotrypa ? rotunda Ulrich.

1893. Mesotrypa ? rotunda. Ulrich, Geol. Minnesota, III, p. 262, fig. 17.
Trenton: Hader, Minnesota.

esotrypa selkirkensis Whiteaves.

1897. Mesotrypa Selkirkensis. Whiteaves, Pal. Foss., III, p. 162, pl. xix, 1, 1*a*.
Trenton: East Selkirk, Canada.

esotrypa ? spinosa Ulrich.

1893. Mesotrypa ? spinosa. Ulrich, Geol. Minnesota, III, p. 259, pl. xvii, 9–12.
Trenton (Black River): Minneapolis and St. Paul, Minnesota.

esotrypa whiteavesi (Nicholson).

1875. Chætetes petropolitanus (in part). Nicholson, Quar. Jour. Geol. Soc. London, XXX, p. 510, pl. xxx, 5, 5*c*.
1875. Chætetes petropolitanus (in part). Nicholson, Pal. Ohio, II, p. 204, pl. xxi, 14–14*b*.
1875. Chætetes petropolitanus (in part). Nicholson, Geol. Mag., new ser., II, p. 175.
1876. Chætetes petropolitanus (in part). Nicholson, Ann. Mag. Nat. Hist., ser. 4, XVIII, p. 88, pl. v, 6*a* (not 6).
1879. Monticulipora (Diplotrypa) Whiteavesii. Nicholson, Paleozoic Tabulate Corals, p. 316, pl. xiii, 4–4*b* (not pl. xiv, 1).
1881. Monticulipora (Diplotrypa) Whiteavesii. Nicholson, Genus Monticulipora, p. 160, fig. 31.
1888. Monticulipora whiteavesii. James and James, Jour. Cincinnati Soc. Nat. Hist., X, p. 169.
1893. Mesotrypa whiteavesii. Ulrich, Geol. Minnesota, III, fig. 15*g*, *h*.
1894. Monticulipora whiteavesii. J. F. James, Jour. Cincinnati Soc. Nat. Hist., XVI, p. 187.
Trenton: Peterboro', Ontario.

ITOCLEMA Ulrich. Genotype: Mitoclema cinctosum Ulrich.

1882. Mitoclema. Ulrich, Jour. Cincinnati Soc. Nat. Hist., V, p. 150.
1890. Mitoclema. Ulrich, Geol. Surv. Illinois, VIII, pp. 336, 369.
1893. Mitoclema. Ulrich, Geol. Minnesota, III, p. 122.
1897. Mitoclema. Simpson, Fourteenth Ann. Rep. State Geologist New York for the year 1894, p. 598.

itoclema cinctosum Ulrich.

1882. Mitoclema cinctosum. Ulrich, Jour. Cincinnati Soc. Nat. Hist., V, p. 159, pl. vi, 7, 7*a*.
1889. Enallopora cinctosa. Miller, North American Geol. Pal., p. 301.
1890. Mitoclema cinctosum. Ulrich, Geol. Sur. Illinois, VIII, pl. liii, 8–8*b*.
1897. Mitoclema cinctosum. Simpson, Fourteenth Ann. Rep. State Geologist New York for the year 1894, figs. 205, 206 (p. 599).
Trenton (Stones River): High Bridge, Kentucky; Murfreesboro, Tennessee.

itoclema ? mundulum Ulrich.

1890. Mitoclema ? mundulum. Ulrich, Jour. Cincinnati Soc. Nat. Hist., XII, p. 177, fig. 4*a*–*c*.
1893. Mitoclema ? mundulum. Ulrich, Geol. Minnesota, III, p. 123, pl. ii, 4–6.
Trenton: Cannon Falls, Minnesota.

MONOTRYPA Nicholson. Genotype: Chætetes undulatus

1879. Monotrypa. Nicholson, Paleozoic Tabulate Corals, p. 293.
1881. Monotrypa. Nicholson, Genus Monticulipora, pp. 102, 168.
1882. Monotrypa. Ulrich, Jour. Cincinnati Soc. Nat. Hist., V, p. 15
1883. Monotrypa. Foord, Contr. Micro-Pal. Cambro-Sil., p. 14.
1886. Monotrypa. Waagen and Wentzel, Pal. Indica, Ser. XIII, 8
1887. Monotrypa. Hall and Simpson, Pal. New York, VI, p. xiii.
1889. Monotrypa. Miller, North American Geol. Pal., p. 196.
1890. Monotrypa. Ulrich, Geol. Surv. Illinois, VIII, p. 379.
1893. Monotrypa. Ulrich, Geol. Minnesota, III, p. 303.
1896. Monotrypa (in part). Zittel's Textb. Pal. (Engl. ed.), p. 104
1897. Monotrypa. Ulrich, Zittel's Textb. Pal. (Engl. ed.), p. 275.
1897. Monotrypa. Simpson, Fourteenth Ann. Rep. State Geologi for the year 1894, p. 581.
1899. Monotrypa. Grabau, Bull. Buffalo Soc. Nat. Sci., VI, p. 136.
1887. Ptychonema. Hall and Simpson, Pal. New York, VI, pp. xi
1889. Ptychonema. Miller, North American Geol. Pal., p. 201.
1897. Ptychonema. Simpson, Fourteenth Ann. Rep. State Geolog for the year 1894, p. 583.

Monotrypa ? amplectens Grabau.

1899. Monotrypa amplectens. Grabau, Bull. Buffalo Soc. Nat. Sc fig. 22.

Hamilton: Averys Creek, Erie County, New York.

Monotrypa colliculata (Hall).

1879. Chætetes colliculatus. Hall, Thirty-second Ann. Rep. Ne Museum, p. 148 (reprint, 1880, p. 10).
1883. Chætetes colliculatus. Hall, Rep. State Geologist New Yor 1882, pl. viii, 1–4.
1887. Chætetes colliculatus. Hall and Simpson, Pal. New York, viii, 1–4.
1893. Monotrypa colliculata. Ulrich, Geol. Minnesota, III, p. 304.

Lower Helderberg: Schoharie, New York.

Monotrypa (Chætetes ?) cumulata Ulrich.

1893. Monotrypa (Chætetes ?) cumulata. Ulrich, Geol. Minnesot pl. xxvii, 26, 27.

Trenton: Goodhue County, Minnesota; Ottawa, Canada.

Monotrypa ? filiasa Ulrich. See Amplexopora filiosa (D'O

Monotrypa fruticosa Grabau. See Chætetes fruticosus ilton).

Monotrypa ? furcata Grabau. See Chætetes furcatus Hall

Monotrypa ? helderbergiæ (Hall).

1874. Chætetes Helderbergiæ. Hall, Twenty-sixth Ann. Rep. Ne Museum, p. 110.
1883. Chætetes Helderbergiæ. Hall, Rep. State Geologist New year 1882, pl. ix 16, 17.
1887. Ptychonema Helderbergiæ. Hall and Simpson, Pal. New 15, pl. ix, 16, 17.
1879. Favosites inexpectans. Hall, Thirty-second Ann. Rep. Ne Museum, p. 146 (reprint, 1880, p. 8).

Lower Helderberg: Clarksville and Schoharie, New York.

onotrypa incerta. Ami. Not recognizable.

1892. Monotrypa incerta. Ami, Canadian Record of Science, V, p. 101.
Trenton: Quebec City, Quebec.

onotrypa intabulata Ulrich.

1893. Monotrypa intabulata. Ulrich, Geol. Minnesota, III, p. 305, fig. 20.
Trenton: Goodhue and Fillmore counties, Minnesota.

onotrypa irregularis Ulrich. See Leptotrypa ? irregularis (Ulrich).

onotrypa magna Ulrich.

1893. Monotrypa magna. Ulrich, Geol. Minnesota, III, pl. 304, p. xxvii, 28, 29.
Trenton (Stones River): Dixon, Illinois; Mineral Point and Beloit, Wisconsin.

onotrypa monticulata (Hall).

1879. Chætetes monticulatus. Hall, Thirty-second Ann. Rep. New York State Museum, p. 148 (reprint, 1880, p. 10).
1882. Monotrypa monticulata. Ulrich, Jour. Cincinnati Soc. Nat. Hist., V, p. 256.
1883. Chætetes monticulatus. Hall, Rep. State Geologist New York for the year 1882, pl. viii, 5–7.
1887. Chætetes monticulatus. Hall and Simpson, Pal. New York, VI, p. 12, pl. viii, 5–7.
Lower Helderberg: Schoharie, New York.

onotrypa nodosa Ulrich.

1882. Monticulipora ? Ortoni (not of Nicholson). Whitfield, Geol. Sur. Wisconsin, IV, p. 251, pl. xi, 7, 8.
1893. Monotrypa nodosa. Ulrich, Geol. Minnesota, III, p. 306.
Cincinnati (Richmond): Iron Ridge and Delafield, Wisconsin; Savannah, Illinois.

onotrypa petasiformis Ulrich. See Amplexopora petasiformis (Nicholson).

onotrypa ? proxima (Hall).

1879. Favosites proximus. Hall, Thirty-second Ann. Rep. New York State Museum, p. 147 (reprint, 1880, p. 9).
1883. Favosites proximus. Hall, Rep. State Geologist New York for the year 1882, pl. vii, 13–15.
1887. Favosites proximus. Hall and Simpson, Pal. New York, VI, p. 10, pl. vii, 13–15.
Lower Helderberg: Schoharie, New York.

onotrypa rectimuralis Ulrich.

1890. Monotrypa rectimuralis. Ulrich, Geol. Sur. Illinois, VIII, p. 462, fig. 3*a* (p. 308), fig. 4*d* (p. 309), pl. xxxviii, 1–1*b*.
1896. Monotrypa rectimuralis. J. F. James, Jour. Cincinnati Soc. Nat. Hist., XVIII, p. 124.
1897. Monotrypa rectimuralis. Simpson, Fourteenth Ann. Rep. State Geologist New York for the year 1894, figs. 151–153 (p. 581).
Trenton: Alexander County, Illinois.

onotrypa sphærica (Hall).

1874. Chætetes spherica. Hall, Twenty-sixth Ann. Rep. New York State Museum, p. 111.
1883. Favosites sphericus. Hall, Rep. State Geologist New York for the year 1882, pl. vii, 1–12.

Monotrypa sphærica (Hall)—Continued.

1887. Favosites sphæricus. Hall and Simpson, Pal. New York, 1–12, pl. viii, 8.
1879. Favosites minimus. Hall, Thirty-second Ann. Rep. N Museum, p. 147 (reprint, 1880, p. 9).
Lower Helderberg: Clarksville, New York.

Monotrypa ? spinosula Hall and Simpson. See Monotry losa Hall and Simpson.

Monotrypa ? ? spinulosa Hall and Simpson.

1883. Species undetermined. Hall, Rep. State Geologist New Y 1882, pl. xvi, 25.
1887. Monotrypa ? spinosula (in error for spinulosa). Hall an New York, VI, p. 67, pl. xvi, 25.
Lower Helderberg: Schoharie, New York.

Monotrypa subglobosa Ulrich. See Monotrypa turbinat

Monotrypa tabulata (Hall).

1876. Chætetes tabulatus. Hall, Illus. Devonian Foss., pl. xxx
1879. Chætetes tabulatus. Hall, Thirty-second Ann. Rep. N Museum, p. 149 (reprint, 1880, p. 11).
1883. Chætetes ? tabulatus. Hall, Rep. State Geologist New Yo 1882, pl. ix, 12–15.
1887. Chætetes (Ptychonema) tabulatus. Hall and Simpson, P VI, p. 14, pl. ix, 12–15.
1889. Ptychonema tabulatum. Miller, North American Geol. P
1893. Monotrypa tabulata. Ulrich, Geol. Minnesota, III, p. 304
1897. Ptychonema tabulatum. Simpson, Fourteenth Ann. Rep. New York for the year 1894, pl. xvii, 9.
Lower Helderberg: Schoharie, New York.

Monotrypa turbinata (James).

1878. Chætetes turbinatum. James, Paleontologist, No. 2, p. 11
1888. Monticulipora turbinata. James and James, Jour. Cinci Hist., X, p. 161, pl. ii, 1*a–c*.
1893. Monticulipora turbinata. J. F. James, Jour. Cincinnati XV, p. 158.
1879. Chætetes subglobosa. Ulrich, Jour. Cincinnati Soc. Nat. pl. xii, 11–11*b*.
1882. Monotrypa subglobosa. Ulrich, Jour. Cincinnati Soc. Nat.
Cincinnati (Utica): Cincinnati, Ohio, and vicinity.

Monotrypa undulata (Nicholson).

1875. Chætetes undulatus. Nicholson, Geol. Mag., new ser., II,
1875. Chætetes undulatus. Nicholson, Pal. Province Ontario, pp
1879. Monticulipora (Monotrypa) undulata. Nicholson, Pale Corals, p. 321, pl. xiv, 3–3*b*, 4, 4*a*.
1881. Monticulipora (Monotrypa) undulata. Nicholson, Genus p. 170, fig. 32 (not fig. 33 = M. undulata-hemispherica
1882. Monotrypa undulata. Ulrich, Jour. Cincinnati Soc. Nat.
1888. Monticulipora undulata. James and James, Jour. Cinci Hist., X, p. 161.
1893. Monticulipora undulata. J. F. James, Jour. Cincinnati XV, p. 157.
Trenton: Belleville and Peterboro, Ontario.

otrypa undulata-hemispherica (J. F. James).

881. Monticulipora (Monotrypa) undulata (in part). Nicholson, Genus Monticulipora, p. 170, fig. 33, *A–C*.

893. Monticulipora undulata var. hemispherica. J. F. James, Jour. Cincinnati Soc. Nat. Hist., XV, p. 157, fig. 10*a–c*.

Cincinnati (Richmond ?): Toronto and Weston, Ontario.

IOTRYPELLA Ulrich. Genotype: Monotrypella æqualis Ulrich.

882. Monotrypella. Ulrich, Jour. Cincinnati Soc. Nat. Hist., V, p. 153.

883. Monotrypella. Foord, Contr. Micro-Pal. Cambro-Sil., p. 15.

887. Monotrypella. Foerste, Bull. Sci. Lab. Denison Univ., II, p. 171.

887. Monotrypella. Hall and Simpson, Pal. New York, VI, p. xiii.

889. Monotrypella. Miller, North American Geol. Pal., p. 196.

890. Monotrypella. Ulrich, Geol. Sur. Illinois, VIII, pp. 377, 451.

896. Monotrypella. Ulrich, Zittel's Textb. Pal. (Engl. ed.), p. 278.

897. Monotrypella. Simpson, Fourteenth Ann. Rep. State Geologist New York, for the year 1894, p. 581.

otrypella ? abrupta (Hall).

879. Chætetes abruptus. Hall, Thirty-second Ann. Rep. New York State Museum, p. 148 (reprint, 1880, p. 10).

883. Chætetes abruptus. Hall, Rep. State Geologist New York, for the year 1882, pl. ix, 9–11.

887. Chætetes (Monotrypella) abruptus. Hall and Simpson, Pal. New York, VI, p. 13, pl. ix, 9–11.

Lower Helderberg: Schoharie, New York.

otrypella æqualis Ulrich.

882. Monotrypella æqualis. Ulrich, Jour. Cincinnati Soc. Nat. Hist., V, p. 247, pl. xi, 3–3*b*.

890. Monotrypella æqualis. Ulrich, Geol. Sur. Illinois, VIII, fig. 3*b* (p. 308), fig. 4*a* (p. 309).

894. Monticulipora æqualis. J. F. James, Jour. Cincinnati Soc. Nat. Hist., XVI, p. 201.

897. Monotrypella æqualis. Simpson, Fourteenth Ann. Rep. State Geologist New York for the year 1894, figs. 154–156 (p. 582).

Cincinnati (Utica): Covington, Kentucky.

otrypella appressa Ulrich. See Eridotrypa appressa (Ulrich).

otrypella ? arbuscula (Hall).

879. Chætetes fruticosus. Hall, Thirty-second Ann. Rep. New York State Museum, p. 148 (reprint, 1880, p. 10).

883. Chætetes fruticosus. Hall, Rep. State Geologist New York, for the year 1882, pl. ix, 1–8.

887. Chætetes (Monotrypella) arbusculus. Hall and Simpson, Pal. New York, VI, p. 12, pl. ix, 1–3 (? 4, 5), 6–8.

Lower Helderberg: Schoharie, New York.

otrypella briarea Ulrich. See Eridotrypa briareus (Nicholson).

otrypella confluens Foerste. See Homotrypa confluens (Foerste).

otrypella ? consimilis (Hall).

876. Chætetes ? consimilis. Hall, Twenty-eighth Ann. Rep. New York State Mus. (documentary edition), pl. ix, 7–14.

879. Chætetes consimilis. Hall, Twenty-eighth Ann. Rep. New York State Museum (Museum edition), p. 110, pl. ix, 7–14.

Monotrypella ? consimilis (Hall)—Continued.

1882. Chætetes consimilis. Hall, Eleventh Ann. Rep. Indiana G
p. 230, pl. viii, 7–14.

1882. Monotrypella consimilis. Ulrich, Jour. Cincinnati Soc. Nat.
Niagara: Waldron, Indiana.

Monotrypella crassimuralis Ulrich.

1890. Monotrypella crassimuralis. Ulrich, Geol. Sur. Illinois,
pl. xxxviii, 2–2*f*.

1894. Monticulipora crassimuralis. J. F. James, Jour. Cincinnati
XVI, p. 208.
Cincinnati (Richmond): Wilmington, Illinois.

Monotrypella ? densa (Hall).

1874. Trematopora densa. Hall, Twenty-sixth Ann. Rep. Ne
Museum, p. 105.

1879. Trematopora (Chætetes) densa. Hall, Thirty-second An
York State Museum, p. 150 (reprint, 1880, p. 12).

1883. Trematopora (Chætetes) densa. Hall, Rep. State Geologi
for the year 1882, pl. x, 11–13.

1887. Chætetes (Monotrypella) densus. Hall and Simpson, Pal.
p. 14, pl. x, 11–13.
Lower Helderberg: Catskill Creek and Schoharie, New Yo
Obs. This species may belong to the genus Eridotrypa.

Monotrypella multitabulata Ulrich. See Callopora m
(Ulrich).

Monotrypella quadrata (Rominger).

1866. Chætetes quadratus. Rominger, Proc. Acad. Nat. Sci. Phila

1881. Monticulipora (Monotrypa) quadrata. Nicholson, Genus
p. 179, fig. 36.

1882. Monotrypella quadrata. Ulrich, Jour. Cincinnati Soc. Nat.

1888. Monticulipora quadrata. James and James, Jour. Cincin
Hist., X, p. 176.

1889. Monotrypella quadrata. Ulrich, Contr. Micro-Pal. Cambr
p. 36.

1894. Monticulipora quadrata. J. F. James, Jour. Cincinnati S
XVI, p. 198.

1895. Monotrypella quadrata. Whiteaves, Pal. Foss., III, p. 116

1874. Chætetes rhombicus. Nicholson, Quar. Jour. Geol. Soc. L
p. 507, pl. xxix, 11–11*b*.

1875. Chætetes rhombicus. Nicholson, Pal. Ohio, II, p. 201, pl.

1876. Chætetes rhombicus. Nicholson, Ann. Mag. Nat. Hist.,
p. 86, pl. v, 1–1*b*.

1878. Monticulipora rectangularis. Whitfield, Ann. Rep. Geol.
for the year 1877, p. 70.

1882. Monticulipora rectangularis. Whitfield, Geol. Sur. Wiscon
pl. xi, 11, 12.

1878. Monticulipora multituberculata. Whitfield, Ann. Rep. Geo
sin for the year 1877, p. 71.

1882. Monticulipora multituberculata. Whitfield, Geol. Sur.
p. 250, pl. xi, 9, 10.
Cincinnati (Richmond): A common and characteristic speci
mond group in Ohio, Indiana, Illinois, Wisconsin, and M

Monotrypella simplex Ulrich. See Eridotrypa appressa (

otrypella subquadrata Ulrich.

1882. Monotrypella subquadrata. Ulrich, Jour. Cincinnati Soc. Nat. Hist., V, p. 249, pl. xi, 4–4*b*.

1894. Monticulipora quadrata var. subquadrata. J. F. James, Jour. Cincinnati Soc. Nat. Hist., XVI, p. 199.

Cincinnati (Richmond): Osgood, Indiana; Blanchester, Hanover, and Oregonia, Ohio.

notrypella Trentonensis Foord. See Eridotrypa trentonensis (Nicholson).

otrypella ? unjiga Whiteaves.

1891. Monotrypella Unjiga. Whiteaves, Contr. Canadian Pal., I, p. 214, pl. xxx, 1–1*d*.

Devonian: Peace River, Vermilion Falls, Canada.

Obs. This species is probably an Eridotrypa.

NTICULIPORA D'Orbigny. Genotype: Monticulipora mammulata 'Orbigny.

1850. Monticulipora. D'Orbigny, Prodr. de Pal., I, p. 25.
1860. Monticulipora. Milne-Edwards, Hist. Nat. des Corall, III., p. 272.
1860. Monticulipora. Eichwald, Lethæa Rossica, I, p. 492.
1872. Monticulipora. De Koninck, Nouv. Rech. Anim. Foss. Terr. Carb. Belgique, p. 141.
1879. Monticulipora. Nicholson, Paleozoic Tabulate Corals, p. 269.
1881. Monticulipora. Nicholson, Genus Monticulipora, p. 99.
1882. Monticulipora. Ulrich, Jour. Cincinnati Soc. Nat. Hist., V, pp. 153, 232.
1883. Monticulipora. Foord, Contr. Micro-Pal. Cambro-Sil., p. 7.
1886. Monticulipora. Waagen and Wentzel, Pal. Indica, Ser. XIII, p. 874.
1888. Monticulipora. James and James, Jour. Cincinnati Soc. Nat. Hist., X, p. 158.
1889. Monticulipora. Miller, North American Geol. Pal., p. 197.
1890. Monticulipora. Ulrich, Geol. Sur. Illinois, VIII, pp. 370, 407.
1893. Monticulipora. Ulrich, Geol. Minnesota, III, p. 217.
1893. Monticulipora. J. F. James, Jour. Cincinnati Soc. Nat. Hist., XV, p. 155.
1896. Monticulipora. Zittel's Textb. Pal. (Engl. ed.), p. 103.
1896. Monticulipora. Ulrich, Zittel's Textb. Pal. (Engl. ed.), p. 272.
1897. Monticulipora. Simpson, Fourteenth Ann. Rep. State Geologist New York for the year 1894, p. 577.
1881. Peronopora (in part). Nicholson, Genus Monticulipora, p. 215.

Obs. By most writers the genus Monticulipora has been given a very wide acceptation. We have employed the term in its restricted sense as defined by Mr. Ulrich in his latest works, but most of the above citations refer to Monticulipora in a much wider sense.

nticulipora æqualis J. F. James. See Monotrypella æqualis Ulrich.

nticulipora affinis J. F. James. See Heterotrypa affinis (Ulrich).

nticulipora (Fistulipora) alternata James and James. See **Cœlolema alternatum (James).**

nticulipora andrewsii James and James. See **Callopora andrewsi Nicholson).**

nticulipora (Heterotrypa) Andrewsii Nicholson. See **Callopora ndrewsi (Nicholson).**

nticulipora (Constellaria) antheloidea James and James. See **Stelliora antheloidea Hall.**

Monticulipora approximatus Hall. See Callopora d
Edwards and Haime).

Monticulipora arborea Ulrich.
1893. Monticulipora arborea. Ulrich, Geol. Minnesota, III, p.
13, 14.
1896. Monticulipora arborea. Ulrich, Zittel's Textb. Pal. (En
(p. 272).
Trenton: Cannon Falls and St. Paul, Minnesota; Decorah
and Frankfort, Kentucky.

Monticulipora arcolata J. F. James. See Aspidopora ar

Monticulipora aspera J. F. James. See Spatiopora aspe

Monticulipora (Dekayia) aspera James and James.
aspera Milne-Edwards and Haime.

Monticulipora asperula J. F. James. See Petigopora asp

Monticulipora (Heterotrypa) Barrandi Nicholson. See H
barrandei (Nicholson).

Monticulipora billingsi Foord.
1883. Monticulipora Billingsi. Foord, Contr. Micro-Pal. Cam
i, 2–2*c*.
Trenton: Near Ottawa City, Canada.

Monticulipora briarea James and James. See Eridotr
(Nicholson).

Monticulipora (Monotrypa) briareus Nicholson. See Er
areus (Nicholson).

Monticulipora calceola Miller and Dyer. See Leptot
(Miller and Dyer).

Monticulipora (Monotrypa) calceola Nicholson. See Le
ceola (Miller and Dyer).

Monticulipora calycula James and James. See Aspidop
(James).

Monticulipora (Diplotrypa) calycula Nicholson. See
calycula (James).

Monticulipora ? cannonensis Ulrich.
1893. Monticulipora ? cannonensis. Ulrich, Geol. Minnesota,
xx, 10–12.
Trenton (Black River and Trenton): Cannon Falls, Minn

Monticulipora cincinnatiensis (James).
1875. Chætetes cincinnatiensis. James, Catal. Sil. Foss. Cincinn
1881. Monticulipora (Peronopora) Cincinnatiensis. Nicholson,
culipora, p. 226, pl. ii, 6–6*c*.
1882. Monticulipora cincinnatiensis. Ulrich, Jour. Cincinnati
V, p. 239.
1888. Monticulipora cincinnatiensis. James and James, Jour.
Nat. Hist., X, p. 170.
1894. Monticulipora cincinnatiensis. J. F. James, Jour. Cinc
Hist., XVI, p. 188.
Cincinnati (Lorraine): Cincinnati, Ohio, and vicinity.

Monticulipora (Peronopora) Cincinnatiensis Nicholson.
culipora cincinnatiensis (James).

onticulipora circularis James. See Calloporella circularis (James).

onticulipora (Heterotrypa) circularis James. See Calloporella circularis (James).

onticulipora clavacoidea James and James. See Leptotrypa clavacoidea (James).

onticulipora (Monotrypa) clavacoidea Nicholson. See Leptotrypa clavacoidea (James).

onticulipora ?? cleavelandi James.

1882. Monticulipora (Heterotrypa ?) cleavelandi. James, Paleontologist, No. 6, p. 49, pl. i, 7.

1888. Monticulipora cleavelandi. James and James, Jour. Cincinnati Soc. Nat. Hist., XI, p. 15, pl. i, 4.

1895. Monticulipora cleavelandi. J. F. James, Jour. Cincinnati Soc. Nat. Hist., XVIII, p. 68.

Cincinnati (Richmond): Lynchburg, Ohio.

Obs. This species may belong to the genus Homotrypa, but the description given is not full enough to determine the genus with any degree of certainty.

onticulipora ?? clintonensis James.

1882. Monticulipora (Heterotrypa) clintonensis. James, Paleontologist, No. 6, p. 45, pl. i, 9.

1888. Monticulipora clintonensis. James and James, Jour. Cincinnati Soc. Nat. Hist., XI, p. 20, pl. i, 1, 1*a*.

1895. Monticulipora clintonensis. J. F. James, Jour. Cincinnati Soc. Nat. Hist., XVIII, p. 73.

Cincinnati (Richmond): Clinton County, Ohio.

Obs. This is almost certainly a synonym for Heterotrypa subramosa (Ulrich).

onticulipora communis James and James. See Callopora oneallicommunis (James).

onticulipora compressa J. F. James. See Peronopora compressa (Ulrich).

onticulipora consimilis Ulrich. See Monticulipora lævis-consimilis Ulrich.

onticulipora contexta J. F. James. See Homotrypella contexta Ulrich.

onticulipora crassimuralis J. F. James. See Monotrypella crassimuralis Ulrich.

onticulipora crustulata James and James. See Chætetes crustulatus James.

onticulipora cumulata J. F. James. See Nicholsonella cumulata Ulrich.

onticulipora curvata J. F. James. See Homotrypa curvata Ulrich.

onticulipora dalei Milne-Edwards and Haime. See Callopora dalei (Milne-Edwards and Haime).

onticulipora Dalii Hall (not Milne-Edwards and Haime). See Callopora ramosa (D'Orbigny).

Monticulipora Dalii White (not Milne-Edwards and Haime).

1875. Monticulipora Dalii. White, Wheeler's Geogr. Geol. Explo
p. 66, pl. iv, 5.

Trenton: Silver Canyon, Pahranagat Range, Nevada.

Obs.—Further study of the original type specimens is needed
what they are, but it can be safely said that they do not b
they were referred.

Monticulipora dawsoni James and James. See Homotryp
(Nicholson).

Monticulipora (Heterotrypa) dawsoni Nicholson. See H
dawsoni (Nicholson).

Monticulipora delicatula James and James. See Bythopora
(Nicholson).

Monticulipora discoidea James and James. See Amplexo
coidea (James).

Monticulipora (Monotrypa) discoidea Nicholson. See Ampl
discoidea (James).

Monticulipora dubia J. F. James. See Diplotrypa? dubia

Monticulipora dychei James. See Leptotrypa? dychei (Jan

Monticulipora (Monotrypa) dychei James. See Leptotryp
(James).

Monticulipora eccentrica James and James. See Aspidop
trica (James).

Monticulipora (Heterotrypa?) eccentrica James. See A
eccentrica (James).

Monticulipora elegans James and James. See Discotryp
(Ulrich).

Monticulipora falesi James.

1884. Monticulipora falesi. James, Jour. Cincinnati Soc. Nat. Hist.,
pl. vii, 2–2*d*.

1888. Monticulipora falesi. James and James, Jour. Cincinnati Soc
X, p. 168.

1894. Monticulipora falesi. J. F. James, Jour. Cincinnati Soc. Nat.
p. 185.

Trenton: Danville, Kentucky.

Obs.—The characters relied upon for making this a species ar
investigation of the types may prove it a valid species.

Monticulipora filiasa D'Orbigny. See Amplexopora filic
bigny).

Monticulipora flabellaris J. F. James. See Homotrypa
Ulrich.

Monticulipora frondosa D'Orbigny. See Heterotrypa
(D'Orbigny).

Monticulipora frondosa James and James (not D'Orbigny).
nopora decipiens (Rominger).

Monticulipora (Peronopora) frondosa Nicholson (not D'Orbig
Peronopora decipiens (Rominger).

onticulipora fusiformis James and James (not Whitfield). See Lioclemella subfusiformis (James).

onticulipora gelasinosa J. F. James. See Homotrypa gelasinosa Ulrich.

onticulipora gracilis James and James. See Bythopora gracilis (Nicholson).

onticulipora (Heterotrypa) gracilis Nicholson. See Bythopora gracilis (Nicholson).

onticulipora grandis Ulrich. See Prasopora grandis (Ulrich).

onticulipora (Fistulipora) granulifera J. F. James. See Homotrypella granulifera (Ulrich).

onticulipora hamiltonense J. F. James. See Monticulipora ? winchelli Ulrich.

onticulipora hospitalis James and James. See Prasopora ? hospitalis (Nicholson).

onticulipora hospitalis var. lævis James and James. See Monticulipora lævis Ulrich.

onticulipora hospitalis var. neglecta James and James. See Prasopora ? hospitalis (Nicholson).

onticulipora imperfectum J. F. James. See Hemiphragma imperfectum (Ulrich).

onticulipora implicatum J. F. James. See Batostoma implicatum (Nicholson).

onticulipora (Heterotrypa) implicata Nicholson. See Batostoma implicatum (Nicholson).

onticulipora incompta Ulrich.

1893. Monticulipora incompta. Ulrich, Geol. Minnesota, III, p. 219, pl. xv, 9–12.
Trenton (Black River): Minneapolis, Minnesota.

onticulipora inflecta J. F. James. See Heterotrypa inflecta Ulrich.

onticulipora irregularis James and James. See Leptotrypa ? irregularis (Ulrich).

onticulipora (Monotrypa) irregularis Nicholson. See Leptotrypa ? irregularis (Ulrich).

onticulipora Jamesi Nicholson. See Batostoma jamesi (Nicholson).

onticulipora (Heterotrypa) Jamesi Nicholson. See Batostoma jamesi (Nicholson).

onticulipora ?? kentuckyensis James.

1883. Monticulipora kentuckensis. James, Paleontologist, No. 7, p. 57, pl. ii, 1–1*b*.

1888. Monticulipora kentuckensis. James and James, Jour. Cincinnati Soc. Nat. Hist., X, p. 180, pl. ii, 6*a*–*d*.

1894. Monticulipora kentuckensis. J. F. James, Jour. Cincinnati Soc. Nat. Hist., XVI, p. 203.

Cincinnati (?): Paris, Kentucky.

Obs.—The genus to which this species belongs can not be determined from the descriptions given.

Monticulipora lævis Ulrich.

1882. Monticulipora lævis. Ulrich, Jour. Cincinnati Soc. Nat. Hist., V, p. 236, pl. x, 1–1*b*.

1888. Monticulipora hospitalis var. lævis. James and James, Jour. Cincinnati Soc. Nat. Hist., XI, p. 27.

1895. Monticulipora lævis. J. F. James, Jour. Cincinnati Soc. Nat. Hist., XVIII, p. 85.

Cincinnati (Richmond): Oxford, Ohio.

Monticulipora lævis-consimilis Ulrich.

1882. Monticulipora consimilis. Ulrich, Jour. Cincinnati Soc. Nat. Hist., V, p. 238, pl. x, 2.

1894. Monticulipora consimilis. J. F. James, Jour. Cincinnati Soc. Nat. Hist., XVI, p. 189.

Cincinnati (Richmond): Oxford, Ohio.

Monticulipora lamellosa Ulrich.

1890. Monticulipora lamellosa. Ulrich, Geol. Sur. Illinois, VIII, p. 408, pl. xxxii, 4–4*b*.

1895. Monticulipora lamellosa. J. F. James, Jour. Cincinnati Soc. Nat. Hist., XVIII, p. 83.

Cincinnati (Richmond): Wilmington, Illinois.

Monticulipora lens James and James (not Nebulipora lens McCoy). See Calloporella circularis (James).

Monticulipora (Dekayia) maculata J. F. James. See Dekayia maculata James.

Monticulipora mammillosa Simpson. See Monticulipora molesta Nicholson.

Monticulipora mammulata James and James (not D'Orbigny). See Heterotrypa frondosa (D'Orbigny).

Monticulipora (Heterotrypa) mammulata Nicholson (not D'Orbigny). See Heterotrypa frondosa (D'Orbigny).

Monticulipora mammulata D'Orbigny.

1850. Monticulipora mammulata. D'Orbigny, Prodr. de Pal., I, p. 25.

1851. Chætetes mammulatus. Milne-Edwards and Haime, Pol. Foss. Terr. Pal., p. 267, pl. xix, 1, 1*a*.

1854. Monticulipora mammulata. Milne-Edwards and Haime, British Foss. Corals, p. 265.

1860. Monticulipora mammulata. Milne-Edwards, Hist. Nat. des Corall., III, p. 276.

1882. Monticulipora mammulata. Ulrich, Jour. Cincinnati Soc. Nat. Hist., V, p. 234.

1883. Monticulipora mammulata. Hall, Twelfth Ann. Rep. Indiana Geol. Nat. Hist., p. 250, pl. xi, 1.

Not Monticulipora mammulata. James and James, Jour. Cincinnati Soc. Nat. Hist., XI, p. 16; J. F. James, ibid., XVIII, p. 69 (=Heterotrypa frondosa (D'Orbigny)).

Cincinnati (Lorraine): Cincinnati, Ohio, and vicinity; Maury County, Tennessee.

Monticulipora mammulata var. molesta Ulrich. See Monticulipora molesta Nicholson.

onticulipora meeki James and James. See Bythopora meeki (James).

onticulipora (Chætetes) meeki James. See Bythopora meeki (James).

onticulipora (Fistulipora) milfordensis James and James. See Cer-
amoporella granulosa-milfordensis (James).

nticulipora molesta Nicholson.

1881. Monticulipora (Peronopora) molesta. Nicholson, Genus Monticulipora, p. 224, pl. vi, 2–2*d*.

1882. Monticulipora mammulata var. molesta. Ulrich, Jour. Cincinnati Soc. Nat. Hist., V, p. 236.

1889. Monticulipora mammulata. Nicholson, Manual Pal., p. 355.

1895. Monticulipora molesta. J. F. James, Jour. Cincinnati Soc. Nat. Hist., XVIII, p. 68.

1897. Monticulipora mammillosa (in error). Simpson, Fourteenth Ann. Rep. State Geologist New York for the year 1894, p. 577, pl. xvii, 1–3.

Cincinnati (Lorraine): Cincinnati, Ohio, and vicinity; Maury County, Tennessee.

onticulipora (Heterotrypa) moniliformis Nicholson. See Hetero-
rypa ? moniliformis (Nicholson).

nticulipora ? monticula White.

1876. Monticulipora monticula. White, Proc. Acad. Nat. Sci. Philadelphia, p. 27.

Hamilton: Iowa City and Buffalo, Iowa.

onticulipora multituberculata Whitfield. See Monotrypella quad-
ata (Rominger).

onticulipora newberryi James and James. See Aspidopora new-
erryi (Nicholson).

onticulipora (Prasopora) Newberryi Nicholson. See Aspidopora
ewberryi (Nicholson).

onticulipora newportensis James and James. See Atactoporella
ewportensis Ulrich.

onticulipora (Fistulipora) nicholsoni James and James. See Chilo-
orella nicholsoni (James).

onticulipora nodulosa James and James. See Callopora nodulosa
Nicholson).

onticulipora (Heterotrypa) nodulosa Nicholson. See Callopora
odulosa (Nicholson).

onticulipora ohioensis James. See Dekayella ulrichi-robusta Foord.

onticulipora o'nealli James and James. See Callopora onealli (James).

onticulipora (Heterotrypa) O'Nealli Nicholson (not of James). See
allopora onealli-sigillarioides (Nicholson).

onticulipora (Heterotrypa) o'nealli ? var. communis James. See Cal-
opora onealli-communis (James).

onticulipora ortoni James and James. See Atactoporella ortoni
Nicholson).

onticulipora (Peronopora ?) Ortoni Nicholson. Se³ Atactoporella
rtoni (Nicholson).

Monticulipora ? Ortoni Whitfield (not of Nicholson). See
nodosa Ulrich.

Monticulipora (Fistulipora) oweni James and James. See
oweni (James).

Monticulipora papillata Milne-Edwards, James and James
lipora papillata McCoy).

1860. Monticulipora papillata. Milne-Edwards, Hist. Nat. des Cora
1888. Monticulipora papillata. James & James, Jour. Cincinnati S
XI, p. 23.
1895. Monticulipora papillata. J. F. James, Jour. Cincinnati Sc
XVIII, p. 81.

Obs. The form referred as above can not be identified from
tion; probably a variety of forms was included.

Monticulipora parasitica Ulrich.

1882. Monticulipora parasitica. Ulrich, Jour. Cincinnati Soc. Na
238, pl. x, 3, *3a*.
1895. Monticulipora parasitica. J. F. James, Jour. Cincinnati Sc
XVIII, p. 81.

Cincinnati (Richmond): Oxford and Hanover, Ohio; Richm
Wilmington and Savannah, Illinois.

Monticulipora parasitica-plana Ulrich.

1889. Monticulipora parasitica var. plana. Ulrich, Contr. Micro-
Sil., Part II, p. 29, pl. viii, 3–*3d*.
1895. Monticulipora parasitica var. plana. Whiteaves, Pal. Foss.,
Cincinnati (Richmond): Stony Mountain, Manitoba.

Monticulipora (Constellaria) parva J. F. James. See Conste
(Ulrich).

Monticulipora pavonia Milne-Edwards. See Escharopo
(D'Orbigny).

Monticulipora (Monotrypa) pavonia Nicholson. See E
pavonia (D'Orbigny).

Monticulipora (Dekayia) pelliculata J. F. James. See Dek
ulata Ulrich.

Monticulipora petasiformis James and James. See A
petasiformis (Nicholson).

Monticulipora (Monotrypa) petasiformis Nicholson. See A
petasiformis (Nicholson).

Monticulipora petasiformis var. welchi James and James. S
opora petasiformis-welchi (James).

Monticulipora petechialis James and James. See Petigopo
alis (Nicholson).

Monticulipora (Constellaria) polystomella James and Jame
olson). See (in part) Constellaria constellata (Van Cleve
(in part) Constellaria polystomella Nicholson.

Monticulipora prolifica J. F. James. See Heterotrypa
prolifica Ulrich.

Monticulipora punctata Whitfield. See Constellaria punc
field).

onticulipora pustulosa J. F. James. See Amplexopora pustulosa Ulrich.

onticulipora quadrata James and James. See Monotrypella quadrata (Rominger).

onticulipora (Monotrypa) quadrata Nicholson. See Monotrypella quadrata (Rominger).

onticulipora quadrata var. subquadrata J. F. James. See Monotrypella subquadrata Ulrich.

onticulipora ramosa D'Orbigny. See Callopora ramosa (D'Orbigny).

onticulipora (Heterotrypa) ramosa Nicholson. See Callopora ramosa (D'Orbigny).

onticulipora ramosa var. dalei James and James. See Callopora dalei (Milne-Edwards and Haime).

onticulipora (Heterotrypa) ramosa var. dalei Nicholson. See Callopora dalei (Milne-Edwards and Haime).

onticulipora ramosa var. rugosa James and James. See Callopora rugosa (Milne-Edwards and Haime).

onticulipora (Heterotrypa) ramosa var. rugosa Nicholson. See Callopora rugosa (Milne-Edwards and Haime).

onticulipora rectangularis Whitfield. See Monotrypella quadrata (Rominger).

onticulipora rugosa Milne-Edwards and Haime. See Callopora rugosa (Milne-Edwards and Haime).

onticulipora (Fistulipora) rustica J. F. James. See Homotrypella rustica Ulrich.

onticulipora selwynii J. F. James (not Nicholson). See Prasopora simulatrix Ulrich.

onticulipora (Prasopora) Selwynii Nicholson. See Prasopora selwyni (Nicholson).

onticulipora (Prasopora) Selwynii var. hospitalis Nicholson. See Prasopora ? hospitalis (Nicholson).

onticulipora septosa James and James. See Amplexopora septosa (Ulrich).

onticulipora simulatrix J. F. James. See Eridotrypa simulatrix (Ulrich).

onticulipora singularis J. F. James. See Heterotrypa singularis (Ulrich).

onticulipora stidhami J. F. James. See Leptotrypa stidhami Ulrich.

onticulipora subcylindrica James. See Amplexopora filiosa (D'Orbigny).

onticulipora (? Monotrypa) subfusiformis James. See Lioclemella subfusiformis (James).

onticulipora subpulchella James and James. See Heterotrypa subpulchella (Nicholson).

Monticulipora (Heterotrypa) subpulchella Nicholson. S
trypa subpulchella (Nicholson).

Monticulipora (Heterotrypa) Trentonensis Nicholson. See
trentonensis (Nicholson).

Monticulipora tuberculata James and James. See Spatiop
culata (Milne-Edwards and Haime).

Monticulipora (Monotrypa) tuberculata Nicholson (not Miln
and Haime). See Spatiopora corticans (Nicholson).

Monticulipora turbinata James and James. See Monotryp
(James).

Monticulipora ulrichi James and James. See Dekaye
(Nicholson).

Monticulipora (Heterotrypa) Ulrichii Nicholson. See
ulrichi (Nicholson).

Monticulipora undulata James and James. See Monotryp
(Nicholson).

Monticulipora (Monotrypa) undulata Nicholson. See
undulata (Nicholson).

Monticulipora undulata var. hemispherica J. F. James.
trypa undulata-hemispherica (J. F. James).

Monticulipora uniformis J. F. James. See Peronopora
Ulrich.

Monticulipora varians James and James. See Batostor
(James).

Monticulipora (Chætetes) varians James. See Batoston
(James).

Monticulipora vaupeli James and James. See Nicholson
(Ulrich).

Monticulipora (Fistulipora) venusta James and James. Se
venusta (Ulrich).

Monticulipora verrucosa J. F. James. See Calloporella
(Ulrich).

Monticulipora (Monotrypa) welchi James. See Amplexop
formis-welchi (James).

Monticulipora westoni Foord.

1883. Monticulipora Westoni. Foord, Contributions Micro-Pal. Can
pl. i, 1–1*b*.

Trenton: Ottawa City, Canada.

Monticulipora wetherbyi Ulrich.

1882 Monticulipora wetherbyi. Ulrich, Jour. Cincinnati Soc. N
p. 239, pl. x, 4–4*b*.

1886. Monticulipora wetherbyi. Ulrich, Fourteenth Ann. Rep. G
Sur. Minnesota, p. 129.

1888. Monticulipora wetherbyi. James and James, Jour. Cincinn
Hist., XI, p. 24.

1889. Monticulipora wetherbyi. Ulrich, Contr. Micro-Pal. Cambr
p. 30.

nticulipora wetherbyi Ulrich—Continued.
1893. Monticulipora wetherbyi. Ulrich, Geol. Minnesota, III, p. 218, pl. xv, 7, 8.
1897. Monticulipora Wetherbyi. Whiteaves, Pal. Foss., III, p. 162.
Trenton (Stones River): High Bridge, Kentucky; Minneapolis, Minnesota; St. Andrews, Manitoba.

onticulipora wetherbyi var. asperula James and James. See Petigopora asperula Ulrich.

onticulipora whiteavesii James and James. See Mesotrypa whiteavesi (Nicholson).

onticulipora (Diplotrypa) Whiteavesii Nicholson. See (in part) Prasopora selwyni (Nicholson), (in part) Prasopora simulatrix-orientalis Ulrich, (in part) Mesotrypa whiteavesi (Nicholson).

onticulipora whitfieldi James and James. See Hemiphragma whitfieldi (James).

onticulipora (Chætetes) whitfieldi James. See Hemiphragma whitfieldi (James).

onticulipora wilmingtonense J. F. James. See Lioclema ? wilmingtonense Ulrich.

nticulipora ? winchelli Ulrich.
1890. Monticulipora winchelli. Ulrich, Geol. Sur. Illinois, VIII, p. 408, pl. xlv, 6, 6*a*.
1895. Monticulipora hamiltonense. J. F. James, Jour. Cincinnati Soc. Nat. Hist., XVIII, p. 87.
Hamilton: Near Alpena, Michigan.

nticulipora ?? winchelli James.
1882. Monticulipora (Heterotrypa) winchelli. James, Paleontologist, No. 6, p. 48.
1883. Monticulipora winchelli. James, Paleontologist, No. 7, pl. i, 5.
1895. Monticulipora winchelli. J. F. James, Jour. Cincinnati Soc. Nat. Hist., XVIII, p. 87.
Cincinnati (Richmond): Near Lynchburg, Highland County, Ohio.
Obs. Species probably valid, but generic position has not yet been determined.

onticulipora (Heterotrypa) winchelli James. See Monticulipora ?? winchelli James.

nticulipora ?? wortheni James.
1882. Monticulipora (Monotrypa) wortheni. James, Paleontologist, No. 6, p. 50, pl. i, 2.
1894. Monticulipora wortheni. J. F. James, Jour. Cincinnati Soc. Nat. Hist., XVI, p. 207.
Cincinnati (Richmond): Lynchburg, Highland County, Ohio.
Obs. The description given is insufficient to decide the generic position.

bulipora McCoy. Genotype: Nebulipora papillata McCoy.
1850. Nebulipora. McCoy, Ann. Mag. Nat. Hist., ser. 2, VI, p. 282.
1852. Nebulipora. McCoy, British Pal. Foss., p. 22.
1882. Nebulipora. Ulrich, Jour. Cincinnati Soc. Nat. Hist., V, p. 155.
Obs. Nothing has been added to McCoy's original descriptions. The genus, apparently monticuliporoid in its structure, not having been characterized with the precision necessary for modern purposes, has not been used by recent writers.

NEMATAXIS Hall. Genotype: Nemataxis fibrosus Hall.

1886. Nemataxis. Hall, Fifth Ann. Rep. State Geologist New York 1885, explanation pl. xxv.
1887. Nemataxis. Hall and Simpson, Pal. New York, VI, p. xv.
1889. Nemataxis. Miller, North American Geol. Pal., p. 313.
1897. Nemataxis. Simpson, Fourteenth Ann. Rep. State Geologis for the year 1894, p. 552.

Nemataxis fibrosus Hall.

1886. Nemataxis fibrosus. Hall, Fifth Ann. Rep. State Geologist N the year 1885, pl. xxv, 30–36.
1887. Nemataxis fibrosus. Hall and Simpson, Pal. New York, VI, 30–36.
1897. Nemataxis fibrosus. Simpson, Fourteenth Ann. Rep. State G York for the year 1894, pl. xvi, 15–18.
Upper Helderberg: Ontario, Canada.

Nemataxis ? simplex Hall and Simpson.

1887. Nemataxis simplex. Hall and Simpson, Pal. New York, VI, p 17–19.
Hamilton: Darien Center, New York.

NEMATOPORA Ulrich. Genotype: Nematopora ovalis Ulr

1888. Nematopora. Ulrich, American Geologist, I, p. 234.
1889. Nematopora. Miller, North American Geol. Pal., p. 313.
1890. Nematopora. Ulrich, Geol. Sur. Illinois, VIII, pp. 401, 644.
1893. Nematopora. Ulrich, Geol. Minnesota, III, p. 204.
1896. Nematopora. Ulrich, Zittel's Textb. Pal. (Eng. ed.), p. 281.
1897. Nematopora. Simpson, Fourteenth Ann. Rep. State Geologi for the year 1894, p. 553.

Nematopora alternata Ulrich.

1890. Nematopora alternata. Ulrich, Geol. Sur. Illinois, VIII, p. 8, 8*a*.
Trenton: Alexander County, Illinois.

Nematopora conferta Ulrich.

1890. Nematopora conferta. Ulrich, Jour. Cincinnati Soc. Nat. Hist fig. 22.
1893. Nematopora conferta. Ulrich, Geol. Minnesota, III, p. 206, pl
Trenton: Cannon Falls, Minnesota.

Nematopora delicatula Ulrich.

1890. Nematopora delicatula. Ulrich, Geol. Sur. Illinois, VIII, p. 11–11*b*.
1893. Nematopora delicatula. Ulrich, Geol. Minnesota, III, p. 206,
1897. Nematopora delicatula. Simpson, Fourteenth Ann. Rep. St New York for the year 1894, figs. 124, 125 (p. 553).
Trenton: Alexander County, Illinois; Cannon Falls, Minneso

Nematopora formosa (Billings).

1866. Helopora formosa. Billings, Catal. Sil. Foss. Anticosti, p. 3
1890. Nematopora formosa. Ulrich, Geol. Sur. Illinois, VIII, p. 6
Anticosti: Anticosti Island.
Obs. See also Helopora ? concava Billings.

Nematopora fragilis Ulrich.

1890. Nematopora fragilis. Ulrich, Geol. Sur. Illinois, VIII, p. 6 10–10*c*.
Trenton: Alexander County, Illinois.

ematopora granosa Ulrich.

1890. Nematopora granosa. Ulrich, Jour. Cincinnati Soc. Nat. Hist., XII, p. 196, fig. 20.

1893. Nematopora granosa. Ulrich, Geol. Minnesota, III, p. 205, pl. iii, 17-20.

Trenton: Cannon Falls, Minnesota.

ematopora lineata (Billings).

1866. Helopora lineata. Billings, Catal. Sil. Foss. Anticosti, p. 36.

1890. Nematopora lineata. Ulrich, Geol. Sur. Illinois, VIII, p. 646, pl. xxix, 7-7*e*.

Anticosti: Anticosti Island.

ematopora ? lineopora (Billings).

1866. Helopora lineopora. Billings, Catal. Sil. Foss. Anticosti, p. 38.

1890. Nematopora ? lineopora. Ulrich, Geol. Sur. Illinois, VIII, p. 645.

Anticosti: Anticosti Island.

ematopora macropora (Hall).

1883. Trematopora ? (Trachypora ?) macropora. Hall, Trans. Albany Institute, X, p. 60 (abstract, 1879, p. 4).

1882. Trematopora ? (Trachypora ?) macropora. Hall, Eleventh Ann. Rep. Indiana Geol. Nat. Hist., p. 236.

Niagara: Waldron, Indiana.

ematopora minuta (Hall).

1876. Trematopora ? (Trachypora ?) minuta. Hall, Twenty-eighth Ann. Rep. New York State Museum (documentary edition), pl. xi, 8.

1879. Trematopora minuta. Hall, Twenty-eighth Ann. Rep. New York State Museum (Museum edition), p. 113, pl. xi, 8.

1882. Trematopora minuta. Hall, Eleventh Ann. Rep. Indiana Geol. Nat. Hist., p. 234, pl. x, 8.

1890. Nematopora minuta. Ulrich, Geol. Sur. Illinois, VIII, p. 645.

Niagara: Waldron, Indiana.

ematopora ovalis Ulrich.

1890. Nematopora ovalis. Ulrich, Jour. Cincinnati Soc. Nat. Hist., XII, p. 197, fig. 21.

1893. Nematopora ovalis. Ulrich, Geol. Minnesota, III, p. 204, pl. iii, 24, 25.

1890. Nematopora quadrata. Ulrich, Geol. Sur. Illinois, VIII, p. 644, pl. xxix, 12-12*c*.

1897. Nematopora quadrata. Simpson, Fourteenth Ann. Rep. State Geologist New York for the year 1894, figs. 124, 125 (p. 553).

Trenton; Cannon Falls, Minnesota; Montreal, Canada; Trenton Falls, New York.

ematopora quadrata Ulrich. See Nematopora ovalis Ulrich.

ematopora raripora (Hall).

1852. Stictopora raripora. Hall, Pal. New York, II, p. 46, pl. xviii, 5*a*-*c*.

1874. Ptilodictya ? raripora. Nicholson and Hinde, Canadian Jour., new ser., XIV, p. 142.

1875. Ptilodictya ? raripora. Nicholson, Pal. Province Ontario, p. 45, figs. 19, 4, 4*a*.

Clinton: Flamborough Head, Ontario.

Niagara: Lockport, New York.

ematopora retrorsa Ulrich.

1890. Nematopora retrorsa. Ulrich, Geol. Sur. Illinois, VIII, p. 645, pl. xxix, 9-9*b*.

Trenton: Alexander county, Illinois.

Nematopora striatopora (Billings).
1866. Helopora striatopora. Billings, Catal. Sil. Foss. Anticosti, p. 39.
1890. Nematopora striatopora. Ulrich, Geol. Sur. Illinois, VIII, p. 645.
Anticosti: Anticosti Island.

Nematopora strigosa (Billings).
1866. Helopora strigosa. Billings, Catal. Sil. Foss. Anticosti, p. 37.
1890. Nematopora strigosa. Ulrich, Geol. Sur. Illinois, VIII, p. 645.
Anticosti: Anticosti Island.

NICHOLSONELLA Ulrich. Genotype: Nicholsonella ponderosa Ulrich.
1890. Nicholsonella. Ulrich, Geol. Sur. Illinois, VIII, pp. 374, 421.
1889. Nicholsonella. (Ulrich, in press), Miller, North American Geol. Pal., p. 313.
1893. Nicholsonella. Ulrich, Geol. Minnesota, III, p. 313.
1896. Nicholsonella. Ulrich, Zittel's Textb. Pal. (Engl. ed.), p. 276.
1897. Nicholsonella. Simpson, Fourteenth Ann. Rep. State Geologist New York for the year 1894, p. 590.

Nicholsonella cumulata Ulrich.
1890. Nicholsonella cumulata. Ulrich, Geol. Sur. Illinois, VIII, p. 423, pl. xxxiii, 6–6*c*.
1895. Monticulipora cumulata. J. F. James, Jour. Cincinnati Soc. Nat. Hist., XVIII, p. 74.
1897. Nicholsonella cumulata. Simpson, Fourteenth Ann. Rep. State Geologist New York for the year 1894, figs. 183–186 (p. 590).
Cincinnati (Richmond): Wilmington, Illinois.

Nicholsonella laminata Ulrich.
1893. Nicholsonella laminata. Ulrich, Geol. Minnesota, III, p. 315, pl. xxi, 15–19, 21.
Trenton (Black River): Minneapolis and St. Paul, Minnesota.

Nicholsonella ponderosa Ulrich.
1890. Nicholsonella ponderosa. Ulrich, Geol. Sur. Illinois, VIII, p. 422, pl. xxxiv, 5–5*d*.
1893. Nicholsonella ponderosa (?). Ulrich, Geol. Minnesota, III, p. 316, pl. xxi, 13, 14, 20, 22.
Trenton (Stones River): Dixon, Illinois; Minneapolis, Minnesota.

Nicholsonella pulchra Ulrich.
1893. Nicholsonella pulchra. Ulrich, Geol. Minnesota, III, p. 314, pl. xxi, 8–12.
1896. Nicholsonella pulchra. Ulrich, Zittel's Textb., Pal. (Eng. ed.), fig. 462 (p. 276).
Trenton (Stones River): Murfreesboro, Tennessee.

Nicholsonella vaupeli (Ulrich).
1883. Heterotrypa vaupeli. Ulrich, Jour. Cincinnati Soc. Nat. Hist., VI, p. 85, pl. i, 2–2*b*.
1888. Monticulipora vaupeli. James and James, Jour. Cincinnati Soc. Nat. Hist., XI, p. 19.
1890. Nicholsonella vaupeli. Ulrich, Geol. Sur. Illinois, VIII, p. 421.
1895. Monticulipora vaupeli. J. F. James, Jour. Cincinnati Soc. Nat. Hist., XVIII, p. 71.
Cincinnati (Lorraine): Cincinnati, Ohio, and vicinity.

Nicholsonia Waagen and Wentzel. See Escharopora Hall.
Nicholsonia Davis (not Waagen and Wentzel). See Hederella Hall.
Nicholsonia adnata Davis. See Hederella adnata (Davis).

angulata Davis. Not a fossil.
cholsonia angulata. Davis, Kentucky Foss. Corals, Part II, pl. lxxx, 16.
milton: Falls of the Ohio.

canadensis Davis. See Hederella canadensis (Nicholson).

pavonica Waagen and Wentzel. See Escharopora pavo-
rbigny).

a Hall. See Buskopora Ulrich.

a alveata Simpson. See Buskopora bistriata (Hall).

ra D'Orbigny. Not recognized. (See Geol. Sur. Illinois,
687).
niretepora D'Orbigny, Prodr. de Pal., I, p. 45.

ra anastomosa D'Orbigny. Not recognizable.
niretepora anastomosa. D'Orbigny, Prodr. de Pal., I, p. 45.
tats-Unis, failles de l'Ohio."

Eichwald. Genotype: Orbitulites distinctus Eichwald.
bitulites. Eichwald, Zool. Spec., I, p. 179. (Name was preoccupied.)
bitulites. Milne-Edwards, Hist. Nat. des Corall., III, p. 271.
bipora. Eichwald, Bull. de la Soc. des Natural. de Moscou, XXIX, p. 92.
bipora. Eichwald, Lethæa Rossica, I, p. 484.
bipora. Dybowsky, Die Chætetiden der Ostbaltischen Silur-Form.,
. 57.
bipora. Nicholson, Genus Monticulipora, p. 24.
bipora. Waagen and Wentzel, Pal. Indica, Ser. XIII, pp. 874, 876.
s. The validity and systematic position of this genus are still in ques-
ion. Of Eichwald's original species, as identified by Dybowski, the
Orbipora distincta is closely related to Chætetes discoideus Nicholson,
which we have doubtfully referred to Amplexopora, as it has certain
haracters which may require its removal to the Heterotrypidæ; the
Orbipora panderi is very different, being an unequivocal Hemiphragma.

A Hall. Genotype: Trematopora regularis Hall.
hopora. Hall, Fifth Ann. Rep. State Geologist New York for the year
885, explanation pl. xxv.
hopora. Hall and Simpson, Pal. New York, VI, pp. xiv, 16.
hopora. Miller, North American Geol. Pal., p. 313.
s. Simpson appears to give up Orthopora by referring the genotype to
Rhombopora (Fourteenth Ann. Rep. State Geologist New York for the
ear 1894, pl. xix, 10, 11); but until the type species is better known
he genus had best be allowed to stand.

ispinulata (Hall).
llopora bispinulata. Hall, Trans. Albany Institute, X, p. 182 (abstract,
881, p. 182).
allopora bispinulata. Hall, Rep. State Geologist New York for the year
883, p. 14.
ematopora (Orthopora) bispinulata. Hall and Simpson, Pal. New
York, VI, p. 182, pl. lv, 27–30, pl. lvi, 16–18.
anthoclema bispinulatum. Miller, North American Geol. Pal., p. 291.
thopora bispinulata. Miller, North American Geol. Pal., p. 313.
milton: Moscow, New York.

analiculata (Hall).
ematopora canaliculata. Hall, Thirty-second Ann. Rep. New York State
Museum, p. 151 (reprint, 1880, p. 13).

Orthopora canaliculata (Hall)—Continued.

1883. Trematopora ? canaliculata. Hall, Rep. State Geologist Ne
year 1882, pl. xi, 12.
1887. Trematopora (Orthopora) canaliculata. Hall and Simpson,
VI, p. 17, pl. xi, 12, pl. xxiii, 9.
Lower Helderberg: Clarksville, New York.

Orthopora carinata (Hall and Simpson).

1887. Trematopora (Orthopora) carinata. Hall and Simpson,
VI, p. 179, pl. lv, 2, pl. lvi, 3.
1898. Trematopora carinata. Whiteaves, Contr. Canadian Pal.,
Hamilton: West Williams, Ontario.

Orthopora elongata (Hall and Simpson).

1887. Trematopora (Orthopora) elongata. Hall and Simpson,
VI, p. 183, pl. lv, 11, pl. lvi, 15.
Hamilton: Near Lake Canandaigua and Lake Owasco, Nev
Obs. Orthopora transversa and Orthopora interplana app
nyms of this species.

Orthopora granifera (Hall and Simpson).

1887. Trematopora (Orthopora) granifera. Hall and Simpson,
VI, p. 186.
Hamilton: Owasco Lake, New York.

Orthopora granilinea (Hall and Simpson).

1887. Trematopora (Orthopora) granilinea. Hall and Simpson,
VI, pl. xxiii, 2.
Lower Helderberg: Clarksville, New York.

Orthopora hexagona (Hall and Simpson).

1887. Trematopora (Orthopora) hexagona. Hall and Simpson,
VI, p. 178, pl. lv, 8, pl. lvi, 2.
1899. Rhombopora hexagona. Grabau, Bull. Buffalo Soc. Nat.
fig. 53.
1897. Rhombopora transversa. Simpson, Fourteenth Ann. Rep.
New York for the year 1894, pl. xix, 12, 13.
Hamilton: Eighteen-Mile Creek, shore of Lake Erie, New

Orthopora immersa (Hall and Simpson.)

1887. Trematopora (Orthopora) immersa. Hall and Simpson,
VI, p. 185, pl. lvi, 11.
1899. Rhombopora immersa. Grabau, Bull. Buffalo Soc. Nat. S
fig. 57.
Hamilton: Darien Center and West Hamburg, New York.

Orthopora interplana (Hall and Simpson).

1887. Trematopora (Orthopora) interplana. Hall and Simpson,
VI, p. 186, pl. lvi, 12.
Hamilton: Near Lake Canandaigua, New York.
Obs. See remark on Orthopora elongata.

Orthopora lineata (Hall and Simpson).

1887. Trematopora (Orthopora) lineata. Hall and Simpson, P
VI, p. 181, pl. lv, 3–6, pl. lvi, 10.
1899. Rhombopora lineata. Grabau, Bull. Buffalo Soc. Nat. Sc
fig. 56.
Hamilton: Darien Center and West Hamburg, New York.

thopora nodosa (Hall and Simpson).

1887. Trematopora (Orthopora) nodosa. Hall and Simpson, Pal. New York, VI, pl. xxiii, 10.

Lower Helderberg: Clarksville, New York.

thopora orbipora (Hall).

1883. Trematopora orbipora. Hall, Trans. Albany Institute, X, p. 181 (abstract, 1881, p. 181).

1884. Trematopora orbipora. Hall, Rep. State Geologist New York for the year 1883, p. 12.

1887. Trematopora (Orthopora ?) orbipora. Hall and Simpson, Pal. New York, VI, p. 188, pl. lv, 13, 14, pl. lvi, 8.

Hamilton: Fallbrook, near Lake Canandaigua, New York.

thopora ornata (Hall and Simpson).

1887. Trematopora (Orthopora) ornata. Hall and Simpson, Pal. New York, VI, p. 184, pl. lv, 1, pl. lvi, 4.

Hamilton: Near Geneseo, New York.

hopora ovatipora (Hall).

1879. Trematopora ovatipora. Hall, Thirty-second Ann. Rep. New York State Museum, p. 151 (reprint, 1880, p. 13).

1883. Trematopora? ovatipora. Hall, Rep. State Geologist New York for the year 1882, pl. xi, 9–11.

1887. Trematopora (Orthopora) ovatipora. Hall and Simpson, Pal. New York, VI, p. 17, pl. xi, 9–11, pl. xxiii, 5.

Lower Helderberg: Clarksville, New York.

hopora parallela (Hall).

1879. Trematopora parallela. Hall, Thirty-second Ann. Rep. New York State Museum, p. 152 (reprint, 1880, p. 14).

1883. Trematopora? parallela. Hall, Rep. State Geologist New York for the year 1882, pl. xi, 13, 14.

1887. Trematopora (Orthopora) parallela. Hall and Simpson, Pal. New York, VI, p. 19, pl. xi, 13, 14, pl. xxiii, 7, 8.

Lower Helderberg: Clarksville, New York.

hopora polygona (Hall).

1883. Trematopora polygona. Hall, Trans. Albany Institute, X, p. 180 (abstract, 1881, p. 180).

1884. Trematopora polygona. Hall, Rep. State Geologist New York for the year 1883, p. 9.

1887. Trematopora (Orthopora) polygona. Hall and Simpson, Pal. New York, VI, p. 176.

1899. Rhombopora polygona. Grabau, Bull. Buffalo Soc. Nat. Sci., VI, p. 164.

Hamilton: West Hamburg, New York.

hopora regularis (Hall).

1874. Trematopora regularis. Hall, Twenty-sixth Ann. Rep. New York State Museum, p. 106.

1879. Trematopora regularis. Hall, Thirty-second Ann. Rep. New York State Museum, p. 151 (reprint, 1880, p. 13).

1883. Trematopora regularis. Hall, Rep. State Geologist New York for the year 1882, pl. xi, 1–8, pl. xiii, 1–3 (in part).

1887. Trematopora (Orthopora) regularis. Hall and Simpson, Pal. New York, VI, p. 16, pl. xi, 1–8, pl. xxiii, 1.

Lower Helderberg: Clarksville, New York.

Orthopora regularis (Hall)—Continued.

1883. Trematopora regularis. Hall, Rep. State Geologist New Yo
1882, pl. xxiv, 5, 6.

1886. Orthopora regularis. Hall, Fifth Ann. Rep. State Geolo
for the year 1885, pl. xxv, 27, 28.

1887. Trematopora (Orthopora) regularis. Hall and Simpson,
VI, p. 71, pl. xxv, 27, 28, pl. xxvi, 5, 6.

1897. Rhombopora regularis. Simpson, Fourteenth Ann. Rep.
New York for the year 1894, pl. xix, 10, 11.

Hamilton: Falls of the Ohio.

Obs. The above arrangement has been given because the
undoubtedly distinct. The Hamilton species should be
Rhombopora lineinodis Ulrich.

Orthopora reticulata (Hall and Simpson).

1887. Trematopora (Orthopora) reticulata. Hall and Simpson,
VI, p. 179, pl. lv, 9, pl. lvi, 5.

1899. Rhombopora reticulata. Grabau, Bull. Buffalo Soc. Nat.
fig. 54.

Hamilton: West Hamburg, Erie County, New York.

Obs. Probably the same as Orthopora subquadrata.

Orthopora rhombifera (Hall).

1874. Trematopora rhombifera. Hall, Twenty-sixth Ann. Rep.
Museum, p. 103.

1879. Trematopora rhombifera. Hall, Thirty-second Ann. Rep.
Museum, p. 152 (reprint, 1880, p. 14).

1883. Trematopora rhombifera. Hall, Rep. State Geologist Ne
year 1882, pl. xi, 15–20.

1887. Trematopora (Orthopora) rhombifera. Hall and Simpson,
VI, p. 18, pl. xi, 15, 17–20, pl. xxiii, 11, 12.

Lower Helderberg: Clarksville and Schoharie, New York.

1883. Trematopora rhombifera. Hall, Rep. State Geologist Ne
year 1882, pl. xxiv, 3, 4.

1886. Orthopora rhombifera. Hall, Fifth Ann. Rep. State Geolo
for the year 1885, pl. xxv, 29.

1887. Trematopora (Orthopora) rhombifera. Hall and Simpson,
VI, p. 71, pl. xxv, 29, pl. xxvi, 3, 4.

Hamilton: Falls of the Ohio.

Obs. The above arrangement has been given because the tw
considered identical by Hall, are undoubtedly distinct.

Orthopora scutulata (Hall).

1883. Trematopora scutulata. Hall, Trans. Albany Institute, X,
1881, p. 6).

1883. Trematopora (Orthopora) scutulata. Hall, Rep. State
York for the year 1882, pl. xxiv, 7, 8.

1887. Trematopora (Orthopora) scutulata. Hall and Simpson,
VI, p. 70, pl. xxvi, 7, 8.

Upper Helderberg: Waterville and Onondaga Valley, New

Orthopora subquadrata (Hall).

1883. Trematopora subquadrata. Hall, Trans. Albany Institu
(abstract, 1881, p. 181).

1884. Trematopora subquadrata. Hall, Rep. State Geologist Ne
year 1883, p. 11.

subquadrata (Hall)—Continued.

Trematopora (Orthopora) subquadrata. Hall and Simpson, Pal. New York, VI, p. 177, pl. lv, 10, pl. lvi, 1, 6.

Hamilton: Darien Center, New York.

Obs. See remark under Orthopora reticulata.

tortalinea (Hall).

Trematopora tortalinea. Hall, Trans. Albany Institute, X, p. 180 (abstract, 1881, p. 180).

Trematopora tortalinea. Hall, Rep. State Geologist New York for the year 1883, p. 10.

Trematopora (Orthopora) tortalinea. Hall and Simpson, Pal. New York, VI, p. 180, pl. lvi, 9.

Rhombopora tortalinea. Grabau, Bull. Buffalo Soc. Nat. Hist., VI, p. 165, fig. 55.

Hamilton: Hamburg, New York.

transversa (Hall).

Trematopora transversa. Hall, Trans. Albany Institute, X, p. 180 (abstract, 1881, p. 180).

Trematopora transversa. Hall, Rep. State Geologist New York for the year 1883, p. 8.

Trematopora (Orthopora ?) transversa. Hall and Simpson, Pal. New York, VI, p. 187, pl. lv, 12, pl. lvi, 13, 14.

Rhombopora ? transversa. Grabau, Bull. Buffalo Soc. Nat. Sci., VI, p. 164, fig. 52.

Hamilton: Hamburg, Erie County, New York.

Obs. See remark under Orthopora elongata.

ICTYA Ulrich. Genotype: Pachydictya robusta Ulrich.

Pachydictya. Ulrich, Jour. Cincinnati Soc. Nat. Hist., V, p. 152.

Pachydictya. Foerste, Bull. Sci. Lab. Denison Univ., II, p. 162.

Pachydictya. Miller, North American Geol. Pal., p. 313.

Pachydictya. Ulrich, Geol. Sur. Illinois, VIII, pp. 390, 522.

Pachydictya. Ulrich, Geol. Minnesota, III, p. 145.

Pachydictya. Simpson, Fourteenth Ann. Rep. State Geologist New York for the year 1894, p. 530.

ya acuta (Hall).

Stictopora ? acuta. Hall, Pal. New York, I, p. 74, pl. xxvi, 3*a*–*b*.

Ptilodictya acuta. Nicholson, Pal. Province Ontario, p. 12, fig. 3.

Stictopora acuta. Ulrich, Jour. Cincinnati Soc. Nat. Hist., V, p. 168, pl. viii, 1–1*b*.

Pachydictya acuta. Ulrich, Fourteenth Ann. Rep. Geol. Nat. Hist. Sur. Minnesota, pp. 75, 76.

Pachydictya acuta. Ulrich, Contr. Micro-Pal. Cambro-Sil., Part II, p. 44.

Pachydictya acuta. Ulrich, Geol. Minnesota, III, p. 155, pl. viii, 11–17, pl. ix, 7.

Pachydictya acuta. Whiteaves, Pal. Foss, III, p. 161.

Stictopora or Pachydictya acuta (in part), of various authors.

Trenton: Trenton Falls and other localities in New York; Burgin, Kentucky; Decorah, Iowa; various localities in Minnesota; St. Andrews, Manitoba.

ya alcyone (Billings).

Ptilodictya alcyone. Billings, Catal. Sil. Foss. Anticosti, p. 36.

Pachydictya alcyone (Billings)—Continued.

1893. Pachydictya alcyone. Ulrich, Geol. Minnesota, III, p. 146.
Anticosti: Anticosti Island.
Obs. This may prove a synonym for Pachydictya crassa (Hall).

Pachydictya arguta Ulrich. See Pachydictya crassa (Hall).

Pachydictya bifurcata (Hall).

1853. Eschara bifurcata. Van Cleve (Mss.).
1883. Stictopora bifurcata. Hall, Twelfth Ann. Rep. Indiana Geol. Nat. Hist., p. 267, pl. xiii, 3, 4.
1887. Pachydictya bifurcata. Foerste, Bull. Sci. Lab. Denison Univ., II, p. 163; ibid., III, 1888, pl. xv, 9.
1895. Pachydictya bifurcata. Foerste, Geol. Sur. Ohio, VII, p. 599, pl. xxviii, 9.
Clinton: Dayton and Fair Haven, Ohio.

Pachydictya bifurcata-instabilis Foerste.

1887. Pachydictya bifurcata var. instabilis. Foerste, Bull. Sci. Lab. Denison Univ., II, p. 164; ibid., III, 1888, pl. xv, 10.
1895. Pachydictya bifurcata var. instabilis. Foerste, Geol. Sur. Ohio, VII, p. 599, pl. xxviii, 10.
Clinton: Near New Carlisle, Ohio.

Pachydictya conciliatrix Ulrich. See Trigonodictya conciliatrix (Ulrich).

Pachydictya crassa (Hall).

1852. Stictopora crassa. Hall, Pal. New York, II, p. 45, pl. xviii, 4*a–c*.
1874. Ptilodictya crassa. Nicholson and Hinde, Canadian Jour., new ser., XIV, p. 142.
1875. Ptilodictya crassa. Nicholson, Pal. Province Ontario, p. 45.
1893. Pachydictya crassa. Ulrich, Geol. Minnesota, III, p. 147.
1866. Ptilodictya rustica. Billings, Catal. Sil. Foss. Anticosti, p. 36.
1893. Pachydictya rustica. Ulrich, Geol. Minnesota, III, p. 146.
1866. Ptilodictya arguta. Billings, Catal. Sil. Foss. Anticosti, p. 36.
1893. Pachydictya arguta. Ulrich, Geol. Minnesota, III, p. 146.
1887. Stictopora scitula. Hall and Simpson, Pal. New York, VI, pl. lxi, 24, 25.
1893. Pachydictya scitula. Ulrich, Geol. Minnesota, III, p. 147.
1889. Ptilodictya farctus. Foerste, Proc. Boston Soc. Nat. Hist., XXIV, p. 328, pl. vi, 31.
1895. Pachydictya farctus. Foerste, Geol. Sur. Ohio, VII, p. 599, pl. xxxi, 31.
1889. Ptilodictya rudis. Foerste, Proc. Boston Soc. Nat. Hist., XXIV, p. 329, pl. vi, 33.
1895. Pachydictya (Rhinidictya) rudis. Foerste, Geol. Sur. Ohio, VII, p. 599, pl. xxxi, 32, 33.
Clinton: Wayne County, New York; Eaton, Ohio; Flamborough and Dundas, Ontario.
Anticosti: Anticosti Island.
Niagara: Lockport, New York.
Obs. Though rather meager in details and varying as to the number of rows of apertures on the frond, there is substantial agreement in all the descriptions cited above. Evidently we have in this species a cosmopolitan form.

Pachydictya elegans Ulrich.

1893. Pachydictya elegans. Ulrich, Geol. Minnesota, III, p. 154, pl. viii, 18, 19, pl. ix, 8, 9.
Trenton: St. Paul, Minnesota; Decorah, Iowa.

chydictya emaciata Foerste.

1887. Pachydictya emaciata. Foerste, Bull. Sci. Lab. Denison Univ., II, p. 62; ibid., III, 1888, pl. xv, 8.
1895. Pachydictya emaciata. Foerste Geol. Sur. Ohio, VII, p. 599, pl. xxviii, 8.
Clinton: Dayton, Ohio.

chydictya emarcescens Foerste. See Ptilodictya expansa-emarcescens (Foerste).

chydictya everetti Ulrich.

1890. Pachydictya everetti. Ulrich, Geol. Sur. Illinois, VIII, p. 523, pl. xxxiii, 1–1*f*.
Trenton (Stones River): Dixon, Illinois.

chydictya ? famelica (Foerste).

1889. Ptilodictya famelicus. Foerste, Proc. Boston Soc. Nat. Hist., XXIV, p. 329, pl. vi, 32.
Clinton: Eaton and Belfast, Ohio.

chydictya farctus Foerste. See Pachydictya crassa (Hall).

chydictya fenestelliformis (Nicholson).

1875. Ptilodictya fenestelliformis. Nicholson, Ann. Mag. Nat. Hist., ser. 4, XV, p. 181, pl. xiv, 5–5*b*.
1875. Ptilodictya fenestelliformis. Nicholson, Pal. Ohio, II, p. 263, pl. xxv, 8–8*b*.
1875. Ptilodictya fenestelliformis. Nicholson, Pal. Province Ontario, p. 14.
1882. Phænopora ? fenestelliformis. Ulrich, Jour. Cincinnati Soc. Nat. Hist., V, pl. viii, 8.
1890. Pachydictya fenestelliformis. Ulrich, Geol. Sur. Illinois, VIII, p. 256.
Cincinnati (Richmond): Blanchester and other localities in Ohio; Wilmington, Illinios; ? Peterborough, Canada (Nicholson).

chydictya fenestelliformis-corticula Ulrich.

1890. Pachydictya fenestelliformis var. corticula. Ulrich, Geol. Sur. Illinois, VIII, p. 526, pl. xxxi, 1.
Cincinnati (Richmond): Wilmington, Illinois.

chydictya fimbriata Ulrich.

1886. Pachydictya fimbriata. Ulrich, Fourteenth Ann. Rep. Geol. Nat. Hist. Sur. Minnesota, p. 75.
1893. Pachydictya fimbriata. Ulrich, Geol. Minnesota, III, p. 152, pl. viii, 28–34, pl. ix. 13, 14.
Trenton (Black River): Minneapolis and St. Paul, Minnesota.

chydictya ? firma Ulrich.

1890. Pachydictya firma. Ulrich, Geol. Sur. Illinois, VIII, p. 525, pl. xxxi, 2–2*f*.
Cincinnati (Richmond): Wilmington, Illinois.

chydictya foliata Ulrich.

1886. Pachydictya foliata. Ulrich, Fourteenth Ann. Rep. Geol. Nat. Hist. Sur. Minnesota, p. 73.
1893. Pachydictya foliata. Ulrich, Geol. Minnesota, III, p. 149, pl. ix, 1–5, pl. x, 5–10.
1896. Pachydictya foliata. Ulrich, Zittel's Textb. Pal. (Eng. ed.), fig. 470 (p. 283).
Trenton (Stones River): Minneapolis, St. Paul, Cannon Falls, Preston, and Fountain, Minnesota.

chydictya gigantea Ulrich.

1890. Pachydictya gigantea. Ulrich, Geol. Sur. Illinois, VIII, p. 524, pl. xxxi, 3–3*e*.
Cincinnati (Richmond): Wilmington, Illinois.

Pachydictya hexagonalis Ulrich.

1889. Pachydictya hexagonalis. Ulrich, Contr. Micro-Pal. Cambro- p. 42, pl. ix, 2–2*c*.
1895. Pachydictya hexagonalis. Whiteaves, Pal. Foss., III, p. 118.
Cincinnati (Richmond): Stony Mountain, Manitoba.

Pachydictya magnipora Ulrich.

1889. Pachydictya magnipora. Ulrich, Contr. Micro-Pal. Cambro-S p. 43.
1897. Pachydictya magnipora. Whiteaves, Pal. Foss., III, p. 161.
Trenton: St. Andrews, Manitoba; Kenyon, Minnesota.

Pachydictya obesa Foerste.

1887. Pachydictya obesa. Foerste, Bull. Sci. Lab. Denison Univ., II, III, 1888, pl. xv, 12.
1895. Pachydictya obesa. Foerste, Geol. Sur. Ohio, VII, p. 599, pl
Clinton: Dayton, Ohio.

Pachydictya occidentalis Ulrich.

1886. Pachydictya occidentalis. Ulrich, Fourteenth Ann. Rep. Geol Sur. Minnesota, p. 75.
1893. Pachydictya occidentalis. Ulrich, Geol. Minnesota, III, p. 20–27, pl. ix, 6–10.
Trenton (Black River): St. Paul and Goodhue County, Minne

Pachydictya pumila Ulrich.

1890. Pachydictya pumila. Ulrich, Jour. Cincinnati Soc. Nat. Hi 186, fig. 11.
1893. Pachydictya pumila. Ulrich, Geol. Minnesota, III, p. 157, p viii, 4, 5.
1890. Rhinidictya humilis. Ulrich, Jour. Cincinnati Soc. Nat. Hist., fig. 10.
Trenton: Cannon Falls, Minnesota; Trenton Falls, New York.

Pachydictya pumila-sublata Ulrich.

1893. Pachydictya pumila var. sublata. Ulrich, Geol. Minnesota, II
Trenton: Cannon Falls, Minnesota.

Pachydictya robusta Ulrich.

1882. Pachydictya robusta. Ulrich, Jour. Cincinnati Soc. Nat. Hist pl. viii, 10*a*–*c*.
Trenton (Stones River): Knoxville, Tennessee.

Pachydictya (Rhinidictya) rudis Foerste. See Pachydict (Hall).

Pachydictya rustica Ulrich. See Pachydictya crassa (Hall).

Pachydictya scitula Ulrich. See Pachydictya crassa (Hall).

Pachydictya ? splendens Ulrich.

1890. Pachydictya splendens. Ulrich, Geol. Sur. Illinois, VIII, p. 5 2*g*, pl. xxxii, 1–1*b*.
Cincinnati (Richmond): Wilmington, Illinois.

Pachydictya triserialis Ulrich.

1890. Pachydictya triserialis. Ulrich, Jour. Cincinnati Soc. Nat. H 187, fig. 12.
1893. Pachydictya triserialis. Ulrich, Geol. Minnesota, III, p. 159, pl
Trenton: Montreal, Canada.

hydictya turgida Foerste.

1887. Pachydictya turgida. Foerste, Bull. Sci. Lab. Denison Univ., II, p. 164; ibid., III, 1888, pl. xv, 11.

1895. Pachydictya turgida. Foerste, Geol. Sur. Ohio, VII, p. 599, pl. xxviii, 11.
Clinton: Dayton and Fair Haven, Ohio.

æocoryne Duncan and Jenkins. Genotype: Palæocoryne scoticum Duncan and Jenkins.

1869. Palæocoryne. Duncan and Jenkins, Phil. Trans. Royal Soc. London, vol. 159, p. 693.

1873. Palæocoryne. Duncan, Quar. Jour. Geol. Soc. London, XXIX, p. 412.

1873. Palæocoryne. Etheridge, Jun., Mem. Geol. Sur. Scotland, explanation sheet 23, p. 96.

1874. Palæocoryne. Young and Young, Geol. Mag., Dec. 2, I, p. 422.

1879. Palæocoryne. Vine, Hardwicke's Science Gossip, XV, pp. 225, 247.
Obs. The authors of this genus considered it hydrozoal in its affinities, but there can be no doubt but that Young and Young were correct in considering the fossils to which the name was given (derived from the Carboniferous shales of Scotland) appendages or processes forming an integral part of the zoarium of Fenestella.

LESCHARA Hall. Genotype: Paleschara incrustans Hall.

1874. Paleschara. Hall, Twenty-sixth Ann. Rep. New York State Museum, p. 107.

1882. Paleschara. Ulrich, Jour. Cincinnati Soc. Nat. Hist., V, p. 157.

1887. Paleschara. Hall and Simpson, Pal. New York, VI, p. xviii.

1889. Paleschara. Miller, North American Geol. Pal., p. 313.

1899. Paleschara. Grabau, Bull. Buffalo Soc. Nat Sci., VI, p. 170.

leschara amplectens Hall. See Leptotrypa ? quadrangularis (Nicholson).

leschara ? aspera Hall. See Paleschara maculata (Hall).

eschara beani (James).

1878. Ceramopora ? beani. James, Paleontologist, No. 1, p. 5.

1884. Ceramopora ? beani. James, Jour. Cincinnati Soc. Nat. Hist., VII, p. 23, fig. 3–3*b*.

1888. Ceramopora ? beani. James and James, Jour. Cincinnati Soc. Nat. Hist., XI, p. 37.

1888. Paleschara beani. Ulrich, American Geologist, I, p. 186.
Cincinnati (Utica and Richmond): Warren County, Ohio; Covington, Kentucky (Utica).

leschara bifoliata Hall. See Ptilodictya nebulosa (Hall).

eschara ?? bilateralis Hall.

1879. Paleschara ? bilateralis. Hall, Thirty-second Ann. Rep. New York State Museum, p. 160 (reprint, 1880, p. 22).

1883. Paleschara ? bilateralis. Hall, Rep. State Geologist New York for the year 1882, pl. xvi, 22, 23.

1887. Paleschara ? (Lichenalia ?) bilateralis. Hall and Simpson, Pal. New York, VI, p. 36, pl. xvi, 22, 23.
Lower Helderberg: Clarksville, New York.

eschara concentrica Hall and Simpson.

1883. Species undetermined. Hall, Rep. State Geologist New York for the year 1882, pl. xvi, 24.

Paleschara concentrica Hall and Simpson—Continued.

1887. Paleschara concentrica. Hall and Simpson, Pal. New York, V pl. xvi, 24.
Lower Helderberg: Clarksville, New York.

Paleschara ? dissimilis (Hall).

1879. Lichenalia dissimilis. Hall, Thirty-second Ann. Rep. New Yo Museum, p. 158 (reprint, 1880, p. 80).
1883. Lichenalia dissimilis. Hall, Rep. State Geologist New York for 1882, pl. xv, 10–13.
1887. Paleschara ? dissimilis. Hall and Simpson, Pal. New York, V pl. xv, 10–13.
Lower Helderberg: Schoharie, New York.

Paleschara ? foliata Hall. See Ptilodictya nebulosa (Hall).

Paleschara ? incrassata Hall.

1879. Paleschara incrassata. Hall, Twenty-eighth Ann. Rep. New Yo Museum (Museum edition), p. 121.
1882. Paleschara incrassata. Hall, Eleventh Ann. Rep. Indiana Ge Hist., p. 246.
Niagara: Waldron, Indiana.

Paleschara incrustans Hall.

1874. Paleschara incrustans. Hall, Twenty-sixth Ann. Rep. New Yo Museum, p. 107.
1879. Paleschara incrustans. Hall, Thirty-second Ann. Rep. New Yo Museum, p. 160 (reprint, 1880, p. 22).
1883. Paleschara incrustans. Hall, Rep. State Geologist New York for 1882, pl. xvi, 15–21, ? 24.
1887. Paleschara incrustans. Hall and Simpson, Pal. New York, VI, xvi, 15–21.
1897. Paleschara incrustans. Simpson, Fourteenth Ann. Rep. State New York for the year 1894, pl. xx, 1, 2.
Lower Helderberg: Clarksville, New York.

Paleschara ? intercella (Hall).

1883. Paleschara intercella. Hall, Trans. Albany Institute, X, p. 179 (1881, p. 179).
1884. Paleschara intercella. Hall, Rep. State Geologist New York for 1883, p. 5.
1891. Paleschara intercella. Hall, Tenth Ann. Rep. State Geologist N for the year 1890, p. 37; Forty-fourth Ann. Rep. New Yo Museum, p. 67.
1899. Paleschara intercella. Grabau, Bull. Buffalo Soc. Nat. Sci., VI,
Hamilton: York and Eighteen-Mile Creek, New York.

Paleschara ? maculata Hall.

1876. Paleschara maculata. Hall, Twenty-eighth Ann. Rep. New Yo Museum (documentary edition), pl. viii, 9, 10; ibid. (Museum 1879), p. 121, pl. viii, 9–13.
1882. Paleschara maculata. Hall, Eleventh Ann. Rep. Indiana Ge Hist., p. 246, pl. vii, 9–13.
1883. Leptotrypa maculata. Ulrich, Jour. Cincinnati Soc. Nat. Hist 158.
1876. Paleschara ? aspera. Hall, Twenty-eighth Ann. Rep. New Yo Museum (documentary edition), pl. viii, 11–13.
Niagara: Waldron, Indiana.

leschara ? offula Hall.

1876. Paleschara offula. Hall, Twenty-eighth Ann. Rep. New York State Museum (documentary edition), pl. viii, 7, 8; ibid. (Museum edition, 1879), p. 120, pl. viii, 7, 8

1882. Paleschara offula. Hall, Eleventh Ann. Rep. Indiana Geol. Nat. Hist., p. 245, pl. vii, 7, 8.

1883. Leptotrypa offula. Ulrich, Jour. Cincinnati Soc. Nat. Hist., VI, p. 158.

Niagara: Waldron, Indiana.

leschara ? pertenuis Hall.

1883. Paleschara ? (Lichenalia ?) pertenuis. Hall, Trans. Albany Institute, X, p. 179 (abstract, 1881, p. 179).

1884. Paleschara ?? (Lichenalia ?) pertenuis. Hall, Rep. State Geologist New York for the year 1883, p. 7.

1891. Paleschara pertenuis. Hall, Tenth Ann. Rep. State Geologist New York for the year 1890, p. 37; Forty-fourth Ann. Rep. New York State Museum, p. 67.

Hamilton: Lodi Landing and Darien Center, New York.

leschara quadrangularis Whiteaves. See Leptrotrypa ? quadrangularis (Nicholson).

leschara ? radiata Hall.

1879. Paleschara ? radiata. Hall, Thirty-second Ann. Rep. New York State Museum, p. 160 (reprint, 1880, p. 22).

1883. Paleschara ? radiata. Hall, Rep. State Geologist New York for the year 1882, pl. xvi, 13, 14.

1887. Paleschara radiata. Hall and Simpson, Pal. New York, VI, p. 35, pl. xvi, 13, 14.

1897. Paleschara radiata. Simpson, Fourteenth Ann. Rep. State Geologist New York for the year 1894, pl. xx, 3.

Lower Helderberg: Clarksville, New York.

leschara ? reticulata Hall.

1883. Paleschara reticulata. Hall, Trans, Albany Institute, X, p. 179 (abstract, 1881, p. 179).

1884. Paleschara reticulata. Hall, Rep. State Geologist New York for the year 1883, p. 6.

1891. Paleschara reticulata. Hall, Tenth Ann. Rep. State Geologist New York for the year 1890, p. 38; Forty-fourth Ann. Rep. New York State Museum, p. 68.

1899. Paleschara reticulata. Grabau, Bull. Buffalo Soc. Nat. Sci., VI, p. 171, fig. 66.

Hamilton: York and Eighteen-Mile Creek, New York.

aleschara ? sphærion Hall. See Leptotrypa ? sphærion (Hall).

aleschara ? (Chætetes ?) sphærion Hall. See Leptotrypa ? sphærion (Hall).

leschara ? tenuis Hall and Simpson.

1887. Paleschara ? tenuis. Hall and Simpson, Pal. New York, VI. p. 36.

Lower Helderberg: Clarksville, New York.

leschara ? variacella Hall.

1883. Paleschara variacella. Hall, Trans. Albany Institute, X, p. 179 (abstract, 1881, p. 179).

1884. Paleschara variacella. Hall, Rep. State Geologist New York for the year 1883, p. 6.

Paleschara ? variacella Hall—Continued.

1891. Paleschara variacella. Hall, Rep. State Geologist New York for the year 1890, p. 39; Forty-fourth Ann. Rep. New York State Museum, p. 69.

Hamilton: York, New York.

PATELLIPORA Rominger. Genotype: Patellipora stellata Rominger.

1887. Patellipora. Rominger, Proc. Acad. Nat. Sci. Philadelphia, p. 11.

Obs. This genus can not be considered fully established, as no details have been made known concerning the internal structure of the type and only known species.

Patellipora stellata Rominger.

1887. Patellipora stellata. Rominger, Proc. Acad. Nat. Sci. Philadelphia, p. 11.

Obs. This species is founded upon three specimens discovered "in drift bowlders at Ann Arbor, associated with characteristic Corniferous limestone fossils in silicified conditions."

Penniretepora D'Orbigny.

1850. Penniretepora. D'Orbigny, Prodr. de Pal., I, p. 45.

1895. Penniretepora. Whidborne, Devon. Fauna England, (Pal. Soc. Publ.), II, pt. 4, p. 185.

Obs. This genus was never properly established.

PERONOPORA Nicholson. Genotype: Monticulipora frondosa Nicholson (not D'Orbigny)=Chætetes decipiens Rominger.

1881. Peronopora. Nicholson, Genus Monticulipora, pp. 102, 215.

1882. Peronopora. Ulrich, Jour. Cincinnati Soc. Nat. Hist., V, p. 153.

1886. Peronopora. Waagen and Wentzel, Pal. Indica, Ser. XIII, p. 875.

1890. Peronopora. Ulrich, Geol. Sur. Illinois, VIII, p. 370.

1896. Peronopora (in part). Zittel's Textb. Pal. (Engl. ed.), p. 104.

1896. Peronopora. Ulrich, Zittel's Textb. Pal. (Engl. ed.), p. 272.

Peronopora compressa (Ulrich).

1879. Chætetes compressus. Ulrich, Jour. Cincinnati Soc. Nat. Hist., II, p. 27, pl. vii, 25–25*b*.

1882. Peronopora compressa. Ulrich, Jour. Cincinnati Soc. Nat. Hist., V, p. 244.

1894. Monticulipora compressa. J. F. James, Jour. Cincinnati Soc. Nat. Hist., XVIII, p. 75.

1882. Peronopora uniformis. Ulrich, Jour. Cincinnati Soc. Nat. Hist., V, p. 244, pl. x, 8, 8*a*.

1895. Monticulipora uniformis. J. F. James, Jour. Cincinnati Soc. Nat. Hist., XVIII, p. 76.

Cincinnati (Lorraine): Cincinnati, Ohio, and vicinity.

Obs. Peronopora uniformis Ulrich is not a valid species, having been founded upon a phase of Peronopora compressa Ulrich in which the mesopores are reduced to a minimum. Other species of Peronopora exhibit this same characteristic.

Peronopora decipiens (Rominger).

1866. Chætetes decipiens. Rominger, Proc. Acad. Nat. Sci. Philadelphia, p. 116.

1882. Peronopora decipiens. Ulrich, Jour. Cincinnati Soc. Nat. Hist., V, p. 244.

1874. Chætetes frondosus (not of D'Orbigny). Nicholson, Quar. Jour. Geol. Soc. London, XXX, p. 508, pl. xxx, 2–2*b*.

1875. Chætetes frondosus (not of D'Orbigny). Nicholson, Pal. Ohio, II, p. 208, pl. xxii, 1–1*b*.

1876. Chætetes frondosus (not of D'Orbigny). Nicholson, Ann. Mag. Nat. Hist., ser. 4, XVIII, p. 91, pl. v, 11, 11*a*.

pora decipiens (Rominger)—Continued.

1. Chætetes frondosus. Quenstedt, Roehren- und Sternkorallen, p. 73, pl. cxlvi, 3–5 (not 8).
1. Monticulipora (Peronopora) frondosa (not of D'Orbigny). Nicholson, Genus Monticulipora, p. 216, figs. 46, 47, pl. v, 4, 4*a*, 5, 5*a*.
8. Monticulipora frondosa (not of D'Orbigny). James and James, Jour. Cincinnati Soc. Nat. Hist., XI, p. 17.
5. Monticulipora frondosa (not of D'Orbigny). J. F. James, Jour. Cincinnati Soc. Nat. Hist., XVIII, p. 72.
Cincinnati (Lorraine and Richmond): Madison and other localities in Indiana; various localities in Ohio, Kentucky, and Tennessee.

opora vera Ulrich.

8. Peronopora vera. Ulrich, American Geologist, II, p. 40.
Cincinnati (Utica): Cincinnati, Ohio, and vicinity.
Obs. This is a good species, but requires further description before the name can be considered valid.

LOTRYPA Ulrich. Genotype: Petalotrypa compressa Ulrich.

0. Petalotrypa. Ulrich, Geol. Sur. Illinois, VIII, pp. 377, 453.
9. Petalotrypa. (Ulrich, in press), Miller, North American Geol. Pal., p. 314.
7. Petalotrypa. Simpson, Fourteenth Ann. Rep. State Geologist New York for the year 1894, p. 582.

trypa compressa Ulrich.

0. Petalotrypa compressa. Ulrich, Geol. Sur. Illinois, VIII, p. 454, pl. xlvi, 4–4*f*.
7. Petalotrypa compressa. Simpson, Fourteenth Ann. Rep. State Geologist New York for the year 1894, figs. 157–159 (p. 582).
Hamilton: Davenport, Iowa; Rock Island, Illinois.

trypa delicata Ulrich.

0. Petalotrypa delicata. Ulrich, Geol. Sur. Illinois, VIII, p. 454, pl. xlvi, 5–5*b*.
Hamilton: Buffalo, Iowa; Rock Island, Illinois.

OPORA Ulrich. Genotype: Petigopora gregaria Ulrich.

2. Petigopora. Ulrich, Jour. Cincinnati Soc. Nat. Hist., V, p. 155.
9. Petigopora. Ulrich, Contr. Micro-Pal. Cambro-Sil., Part II, p. 34.
9. Petigopora. Miller, North American Geol. Pal., p. 314.
0. Petigopora. Ulrich, Geol. Sur. Illinois, VIII, p. 372.
6. Petigopora. Ulrich, Zittel's Textb. Pal. (Engl. ed.), p. 274.
7. Petigopora. Simpson, Fourteenth Ann. Rep. State Geologist New York for the year 1894, p. 563.

pora asperula Ulrich.

3. Petigopora asperula. Ulrich, Jour. Cincinnati Soc. Nat. Hist., VI, p. 157, pl. vi, 4–4*c*.
6. Petigopora asperula. Ulrich, Fourteenth Ann. Rep. Geol. Nat. Hist. Sur. Minnesota, p. 130.
8. Monticulipora wetherbyi var. asperula. James and James, Jour. Cincinnati Soc. Nat. Hist., XI, p. 24.
5. Monticulipora asperula. J. F. James, Jour. Cincinnati Soc. Nat. Hist., XVIII, p. 81.
7. Petigopora gregaria (in part). Simpson, Fourteenth Ann. Rep. State Geologist New York for the year 1894, fig. 129 (in part) (p. 564).
Cincinnati (Lorraine): Cincinnati, Ohio, and vicinity.

Petigopora gregaria Ulrich.

1883. Petigopora gregaria. Ulrich, Jour. Cincinnati Soc. Nat. Hist., VI, p. 155, pl. vii, 3–3*c*.
1896. Petigopora gregaria. J. F. James, Jour. Cincinnati Soc. Nat. Hist., XVIII, p. 124.
1897. Petigopora gregaria. Simpson, Fourteenth Ann. Rep. State Geologist New York for the year 1894, fig. 129 (in part)(p. 564).
Cincinnati (Lorraine): Cincinnati, Ohio, and vicinity.

Petigopora petechialis (Nicholson).

1875. Chætetes petechialis. Nicholson, Pal. Ohio, II, p. 213, pl. xxii, 5, 5*a*.
1883. Petigopora petechialis. Ulrich, Jour. Cincinnati Soc. Nat. Hist., VI, p. 156.
1886. Petigopora petechialis. Ulrich, Fourteenth Ann. Rep. Geol. Nat. Hist. Sur. Minnesota, p. 103.
1888. Monticulipora petechialis. James and James, Jour. Cincinnati Soc. Nat. Hist., XI, p. 24.
1889. Petigopora petechialis. Miller, North American Geol. Pal., fig. 496 (p. 314).
1895. Monticulipora petechialis. J. F. James, Jour. Cincinnati Soc. Nat. Hist., XVIII, p. 85.
Cincinnati (Lorraine): Cincinnati, Ohio, and vicinity.

Petigopora scabiosa Ulrich.

1889. Petigopora scabiosa. Ulrich, Contr. Micro-Pal. Cambro Sil., Part II, p. 34.
1897. Petigopora scabiosa. Whiteaves, Pal. Foss., III, p. 116.
Cincinnati (Richmond): Stony Mountain, Manitoba.

PHACELOPORA Ulrich. Genotype: Phacelopora pertenuis Ulrich.

1890. Phacelopora. Ulrich, Geol. Sur. Illinois, VIII, p. 368.
1889. Phacelopora. (Ulrich, in press), Miller, North American Geol. Pal., p. 314.
1897. Phacelopora. Simpson, Fourteenth Ann. Rep. State Geologist New York for the year 1894, p. 600.

Phacelopora constricta Ulrich.

1890. Phacelopora constricta. Ulrich, Geol. Sur. Illinois, VIII, p. 406, pl. xxix, 2.
1897. Phacelopora constricta. Simpson, Fourteenth Ann. Rep. State Geologist New York for the year 1894, fig. 209 (p. 600).
Trenton: Burgin, Kentucky.
Obs. Mr. Ulrich now regards this as the interior cast of some undetermined species of Helopora or Arthroclema.

Phacelopora pertenuis Ulrich.

1890. Phacelopora pertenuis. Ulrich, Geol. Sur. Illinois, VIII, p. 406, pl. xxix, 1–1*c*.
1894. Phacelopora pertenuis. Keyes, Missouri Geol. Sur., V, p. 13, pl. xxxiii, 3.
1897. Phacelopora pertenuis. Simpson, Fourteenth Ann. Rep. State Geologist New York for the year 1894, figs. 207, 208 (p. 600).
Trenton: Thebes, Illinois.

PHÆNOPORA Hall. Genotype: Phænopora explanata Hall.

1852. Phænopora. Hall, Pal. New York, II, p. 46.
1882. Phænopora. Ulrich, Jour. Cincinnati Soc. Nat. Hist., V, p. 152.
1887. Phænopora. Foerste, Bull. Sci. Lab. Denison Univ., II, p. 157.
1889. Phænopora. Miller, North American Geol. Pal., p. 314.
1890. Phænopora. Ulrich, Geol. Sur. Illinois, VIII, p. 392.

OPORA Hall—Continued.

3. Phænopora. Ulrich, Geol. Minnesota, III, p. 173.

3. Phænopora. Ulrich, Zittel's Textb. Pal. (Engl. ed.), p. 279.

7. Phænopora. Simpson, Fourteenth Ann. Rep. State Geologist New York for the year 1894, p. 541.

ora constellata Hall.

2. Phænopora constellata. Hall, Pal. New York, II, p. 47, pl. xviii, 7*a*–*e*.

. Phænopora constellata. Miller, North American Geol. Pal., fig. 497 (p. 314).

. Phænopora constellata. Ulrich, Geol. Sur. Illinois, VIII, fig. 12*a*, *b* (p. 392).

Clinton: Wayne County, New York; Hamilton, Ontario.

ora ensiformis Hall.

2. Phænopora ensiformis. Hall, Pal. New York, II, p. 48, pl. xviii, 8*a*–*c*.

. Phænopora ensiformis. Nicholson and Hinde, Canadian Jour., new ser., XIV, p. 142.

5. Phænopora ensiformis. Nicholson, Pal. Province Ontario, p. 45, fig. 19, 2, 2*a*.

2. Ptilodictya ensiformis. Ulrich, Jour. Cincinnati Soc. Nat. Hist., V, p. 172.

5. Phænopora ensiformis. Foerste, Geol. Sur. Ohio, VII, p. 598.

Clinton: Flamborough, Dundas, and Hamilton, Ontario.

pora excellens (Billings).

3. Ptilodictya excellens. Billings, Catal. Sil. Foss. Anticosti, p. 34.

2. Stictoporella ? excellens. Ulrich, Jour. Cincinnati Soc. Nat. Hist., V, p. 169.

. Phænopora excellens. Miller, North American Geol. Pal., p. 314.

Anticosti: Anticosti Island.

Obs. Compare Phænopora explanata Hall.

pora expansa Hall and Whitfield.

3. Eschara bipunctata. Van Cleve (MSS.).

5. Phænopora (Ptilodictya) expansa. Hall and Whitfield, Pal. Ohio, II, p. 114, pl. v, 1.

3. Ptilodictya expansa (in part). Hall, Twelfth Ann. Rep. Indiana Geol. Nat. Hist., p. 266. (Gives the original description, but pl. xii, 1, 2 is the Ptilodictya expansa, which see).

. Phænopora expansa. Ulrich, Geol. Sur. Illinois, VIII, fig. 12*c* (p. 392).

5. Phænopora expansa. Foerste, Geol. Sur. Ohio, VII, p. 598, pl. xxix, 1.

. Ptilodictya platyphylla. James, Paleontologist, No. 3, p. 21.

7. Phænopora platyphylla. Foerste, Bull. Sci. Lab. Denison Univ., II, p. 157; ibid., III, 1888, pl. xvi, 1.

3. Ptilodictya bipunctata. Hall, Twelfth Ann. Rep. Indiana Geol. Nat. Hist., p. 266, pl. xiii, 5.

Not Ptilodictya expansa. Foerste, Bull. Sci. Lab. Denison Univ., II, 1887, p. 155; ibid., III, 1888, pl. xv, 5; Proc. Boston Soc. Nat. Hist., XXIV, 1889, p. 327.

Clinton: Dayton and Clinton County, Ohio.

pora (Ptilodictya) expansa Hall and Whitfield. See Phænopora nsa Hall and Whitfield.

pora explanata Hall.

2. Phænopora explanata. Hall, Pal. New York, II, p. 46, pl. xviii, 6*a*–*e*.

Clinton: Flamborough Head and Hamilton, Ontario.

Obs. See also Phænopora excellens (Billings).

Phænopora ? fenestelliformis Ulrich. See Pachydictya fen
(Nicholson).

Phænopora fimbriata (James).

1853. Eschara ramosa. Van Cleve (MSS.).
1878. Ptilodictya fimbriata. James, Paleontologist, No. 1, p. 8.
1887. Phænopora fimbriata. Foerste, Bull. Sci. Lab. Denison U
ibid., III, 1888, pl. xv, 7.
1889. Phænopora fimbriata. Foerste, Proc. Boston Soc. Nat. H
330.
1895. Phænopora fimbriata. Foerste, Geol. Sur. Ohio, VII, p. 5
1883. Stictopora vanclevii. Hall, Twelfth Ann. Rep. Indiana G
p. 268, pl. xiii, 1, 2.
Clinton: Clinton County, Belfast, and Dayton, Ohio.

Phænopora incipiens Ulrich.

1893. Phænopora incipiens. Ulrich, Geol. Minnesota, III, p. 174
Trenton: Montreal, Canada; Chimney Point, Vermont; St
sota.

Phænopora lirata (Hall).

1874. Escharopora lirata. Hall, Twenty-sixth Ann. Rep. Ne
Museum, p. 100.
1879. Escharopora lirata. Hall, Thirty-second Ann. Rep. N
Museum, p. 161 (reprint, 1880, p. 23).
1883. Escharopora (Ptilodictya) lirata (in part). Hall, Rep.
New York for the year 1882, pl. xvii, 1–6.
1887. Ptilodictya lirata. Hall and Simpson, Pal. New York, VI,
1–4, pl. xxiiiA, 20.
1897. Phænopora lirata. Simpson, Fourteenth Ann. Rep. State
York for the year 1894, pl. xv, 8.
Lower Helderberg: Clarksville, New York.

Phænopora magna (Hall and Whitfield).

1853. Eschara compressa. Van Cleve (MSS.).
1875. Stictopora magna. Hall and Whitfield, Pal. Ohio, II, p.
1887. Phænopora magna. Foerste, Bull. Sci. Lab. Denison U
ibid., III, 1888, pl. xv, 6, pl. xvi, 2.
1889. Phænopora magna. Foerste, Proc. Boston Soc. Nat. Hist.
1895. Phænopora magna. Foerste, Geol. Sur. Ohio, VII, p. 59
pl. xxix, 2*a–c*.
1883. Stictopora compressa. Hall, Twelfth Ann. Rep. Indiana G
p. 267, pl. xiv, 3.
Clinton: Dayton and Belfast, Ohio.

Phænopora multifida (Hall).

1853. Eschara multifida. Van Cleve (MSS.)
1878. Ptilodictya sp. (?). James, Paleontologist, No. 1, p. 8. (
suggested.)
1883. Stictopora multifida. Hall, Twelfth Ann. Rep. Indiana G
p. 268, pl. xiv, 4.
1887. Phænopora multifida. Foerste, Bull. Sci. Lab. Denison U
ibid., III, 1888, pl. xvi, 3.
1895. Phænopora multifida. Foerste, Geol. Sur. Ohio, VII, p. 5
Clinton: Dayton, Ohio; Hanover, Ohio, Indiana.

Phænopora multipora Hall. See Eurydictya multipora (

opora platyphylla Foerste. See Phænopora expansa Hall and itfield.

pora punctata (Nicholson and Hinde).

74. Ptilodictya ? punctata. Nicholson and Hinde, Canadian Jour., new ser., XIV, p. 143, fig. 1*a–b*.
74. Ptilodictya ? punctata. Nicholson, Pal. Province Ontario, p. 46, fig. 20.
93. Phænopora punctata. Ulrich, Geol. Minnesota, III, p. 174.
Clinton: Dundas, Ontario.

pora superba (Billings).

36. Ptilodictya superba. Billings, Catal. Sil. Foss. Anticosti, p. 35.
93. Phænopora superba. Ulrich, Geol. Minnesota, III, p. 174.
Anticosti: Anticosti Island.

pora tenuis (Hall).

74. Escharopora tenuis. Hall, Twenty-sixth Ann. Rep. New York State Museum, p. 99.
79. Escharopora tenuis. Hall, Thirty-second Ann. Rep. New York State Museum, p. 161 (reprint, 1880, p. 23).
33. Escharopora (Ptilodictya) tenuis (in part). Hall, Rep. State Geologist New York for the year 1882, pl. xiii, 14; pl. xvii, 7–13.
37. Ptilodictya tenuis. Hall and Simpson, Pal. New York, VI, p. 39, pl. xiii, 14; pl. xvii, 7–12; pl. xxiii A, 15.
39. Phænopora tenuis. Miller, North American Geol. Pal., p. 315.
97. Phænopora tenuis. Simpson, Fourteenth Ann. Rep. State Geologist New York for the year 1894, pl. xv, 9, 10.
Lower Helderberg: Albany and Schoharie counties, New York.

pora wilmingtonensis Ulrich.

93. Phænopora wilmingtonensis. Ulrich, Geol. Minnesota, III, p. 175, pl. xiii, 22–26.
Cincinnati (Richmond): Wilmington, Illinois.

CTOPORA Hall. Genotype: Phractopora cristata Hall.

33. Phractopora. Hall, Trans. Albany Institute, X, p. 154 (abstract, 1881, p. 12).
37. Phractopora. Hall and Simpson, Pal. New York, VI, p. xvii.
39. Phractopora. Miller, North American Geol. Pal., p. 315.
97. Phractopora. Simpson, Fourteenth Ann. Rep. State Geologist New York for the year 1894, p. 539.

topora cristata Hall.

33. Phractopora cristata. Hall, Trans. Albany Institute, X, p. 154 (abstract, 1881, p. 12).
36. Phractopora cristata. Hall, Fifth Ann. Rep. State Geologist New York for the year 1885, pl. xxxi, 36–38.
37. Phractopora cristata. Hall and Simpson, Pal. New York, VI, p. 99, pl. xxxi, 36–38.
97. Phractopora cristata. Simpson, Fourteenth Ann. Rep. State Geologist New York for the year 1894, pl. xxiv, 11–13.
36. Lichenalia (Phractopora) cristata var. lineata. Hall, Fifth Ann. Rep. State Geologist New York for the year 1885, pl. xxxi, 34, 35.
37. Phractopora cristata var. lineata. Hall and Simpson, Pal. New York, VI, p. 99, pl. xxxi, 34, 35.
97. Phractopora lineata. Simpson, Fourteenth Ann. Rep. State Geologist New York for the year 1894, pl. xxiv, 14.
Hamilton: Falls of the Ohio.

Phractopora cristata var. lineata Hall. See Phractopora cristata Hall.

Phractopora lineata Simpson. See Phractopora cristata Hall.

Phractopora megastoma (Ulrich).

1890. Glyptopora megastoma. Ulrich, Geol. Sur. Illinois, VIII, p. 518, pl. lxxviii, 5, *5a*.

1888. Glyptopora megastoma. Ulrich, Bull. Denison Univ., IV, p. 83. (Not defined.)

1894. Glyptopora megastoma. Keyes, Missouri Geol. Sur., V, p. 21.

Keokuk: Warsaw and Nauvoo, Illinois; Keokuk and Bentonsport, Iowa. Waverly: Sciotoville, Ohio.

Phractopora michelinia Simpson. See Glyptopora sagenella-lata Ulrich.

Phractopora pinnata (Ulrich).

1890. Glyptopora pinnata. Ulrich, Geol. Sur. Illinois, VIII, p. 156, pl. lxxviii, 2.

Burlington: Sagetown, Henderson County, Illinois.

Phractopora sagenella Simpson (not Prout). See Glyptopora michelinia (Prout).

Phractopora trifolia (Rominger).

1866. Fistulipora trifolia. Rominger, Proc. Acad. Nat. Sci. Philadelphia, p. 122.

1890. Prismopora trifolia. Ulrich, Geol. Sur. Illinois, VIII, p. 505, pl. lxxvii, 4–*4b*.

1894. Prismopora trifolia. Keyes, Missouri Geol. Surv., V, p. 18.

Keokuk: Lagrange, Missouri; Keokuk, Iowa; Warsaw, Illinois.

PHYLLODICTYA Ulrich. Genotype: Phyllodictya frondosa Ulrich.

1882. Phyllodictya. Ulrich, Jour. Cincinnati Soc. Nat. Hist., V, p. 153.

1889. Phyllodictya. Miller, North American Geol. Pal., p. 315.

1890. Phyllodictya. Ulrich, Geol. Sur. Illinois, VIII, p. 390.

1893. Phyllodictya. Ulrich, Geol. Minnesota, III, p. 141.

1896. Phyllodictya. Ulrich, Zittel's Textb. Pal. (Engl. ed.), p. 280.

1897. Phyllodictya. Simpson, Fourteenth Ann. Rep. State Geologist New York for the year 1894, p. 531.

Phyllodictya frondosa Ulrich.

1882. Phyllodictya frondosa. Ulrich, Jour. Cincinnati Soc. Nat. Hist., V, p. 174, pl. viii, 11–*11b*.

1893. Phyllodictya frondosa (?). Ulrich, Geol. Minnesota, III, p. 142.

1897. Phyllodictya frondosa. Simpson, Fourteenth Ann. Rep. State Geologist New York for the year 1894, fig. 88 (p. 531).

Trenton (Stones River): High Bridge and Frankfort, Kentucky; ? Minneapolis, Minnesota.

Phyllodictya varia Ulrich.

1893. Phyllodictya varia. Ulrich, Geol. Minnesota, III, p. 144, pl. xiv, 1–8.

Trenton (Black River): Minneapolis and Cannon Falls, Minnesota.

PHYLLOPORA King. Genotype: Gorgonia ehrenbergi Geinitz.

1849. Phyllopora. King, Ann. Mag. Nat. Hist., ser. 2, II, p. 389.

1850. Phyllopora. King, Mon. Permian Foss. England, p. 40.

1882. Phyllopora. Ulrich, Jour. Cincinnati Soc. Nat. Hist., V, p. 150.

1885. Phyllopora. Waagen and Pichl, Pal. Indica, Ser. XIII, pp. 774, 796.

1886. Phyllopora. Ulrich, Contr. American Pal., I, p. 5.

1889. Phyllopora. Miller, North American Geol. Pal., p. 315.

LOPORA King—Continued.

35. Phyllopora. Simpson, Thirteenth Ann. Rep. State Geologist New York for the year 1893, pp. 718, 726; Forty-seventh Ann. Rep. New York State Museum, pp. 912, 920.

96. Phyllopora. Ulrich, Zittel's Textb. Pal. (Engl. ed.), p. 283.

97. Phyllopora. Simpson, Fourteenth Ann. Rep. State Geologist New York for the year 1894, pp. 512, 520.

pora aspera Ulrich.

90. Phyllopora aspera. Ulrich, Geol. Sur. Illinois, VIII, p. 613, pl. xliv, 5–5*b*.
Hamilton: Falls of the Ohio.

opora ? corticosa Ulrich. See Phylloporina corticosa (Ulrich).

opora ehrenbergi Swallow (not Geinitz).

58. Phyllopora ehrenbergi. Swallow, Trans. St. Louis Acad. Sci., I, p. 180.
Lower Permian: Kansas.
Obs.—As no description was given, the form so identified can not be recognized.

opora superba Ulrich. See Reteporidra perundata (Hall).

opora variolata Ulrich. See Phylloporina variolata (Ulrich).

LOPORINA Ulrich. Genotype: Retepora Trentonensis Nicholson.

Retepora, as applied by various authors to Ordovician and Silurian anastomosing bryozoa (not Lamarck, 1801).

47. Gorgonia (?). Hall, Pal. New York, I, pp. 16, 76 (not Linnæus, 1745).

47. Intricaria. Hall, Pal. New York, I, p. 77.

78. Intricaria. Miller and Dyer, Contr. Pal., No. 2, p. 7.

50. Subretepora. D'Orbigny, Prodr. de Pal., I, p. 22.

39. Subretepora. Miller, North American Geol. Pal., p. 326. (See Geol. Sur. Illinois, VIII, pp. 683, 687.)

32. Phyllopora (in part). Ulrich, Jour. Cincinnati Soc. Nat. Hist., V, p. 150.

36. Nov. Gen. (not named). Ulrich, Contr. American Pal., I, p. 5.

37. Phylloporina. (Ulrich), Foerste, Bull. Sci. Lab. Denison Univ., II, p. 150.

90. Phylloporina. Ulrich, Geol. Sur. Illinois, VIII, pp. 399, 639.

93. Phylloporina. Ulrich, Geol. Minnesota, III, p. 208.

96. Phylloporina. Ulrich, Zittel's Textb. Pal. (Engl. ed.), p. 283.

porina angulata (Hall).

52. Retepora angulata. Hall, Pal. New York, II, p. 49, pl. xix, 3*a*–*h*.

75. Retepora angulata (?). Hall and Whitfield, Pal. Ohio, II, p. 111, pl. v. 2–4.

32. Retepora angulata. Hall, Twelfth Ann. Rep. Indiana Geol. Nat. Hist., p. 269, pl. xiv, 1, 2.

37. Phylloporina angulata. Foerste, Bull. Sci. Lab. Denison Univ., II, p. 151; ibid., III, 1888, pl. xv, 1.

39. Subretepora angulata. Miller, North American Geol. Pal., fig. 523 (p. 326).

95. Phylloporina angulata. Foerste, Geol. Sur. Ohio, VII, p. 600, pl. xxviii, 1.
Clinton: Rochester and Sodus, New York; Flamborough, Canada; Dayton, Todds Fork, Fair Haven, and Centerville, Ohio.

porina aspera (Hall).

47. Gorgonia ? aspera. Hall, Pal. New York, I, p. 16, pl. iv, 3*a*, *b*.

39. Subretepora aspera. Miller, North American Geol. Pal., p. 326.

90. Phylloporina aspera. Ulrich, Geol. Sur. Illinois, VIII, p. 332, pl. liii, 4–4*c*.
Chazy: Chazy, New York; Mingan, Canada.

Phylloporina asperato-striata (Hall).

1852. Retepora asperato-striata. Hall, Pal. New York, II, p. 16
1889. Subretepora asperato-striata. Miller, North American Ge
1890. Phylloporina asperato-striata. Ulrich, Geol. Sur. Illinois, liii, 5–5*b*.
Niagara: Lockport, New York.

Phylloporina clathrata (Miller and Dyer).

1878. Intricaria clathrata. Miller and Dyer, Contr. Pal., No. 2,
1889. Subretepora clathrata. Miller, North American Geol. Pa
1890. Phylloporina clathrata. Ulrich, Geol. Sur. Illinois, VIII,
Cincinnati (Lorraine): Cincinnati, Ohio, and vicinity.

Phylloporina corticosa (Ulrich).

1886. Phyllopora ? corticosa. Ulrich, Fourteenth Ann. Rep. G Sur. Minnesota, p. 61.
1889. Subretepora corticosa. Miller, North American Geol. Pal
1890. Phylloporina corticosa. Ulrich, Geol. Sur. Illinois, VIII 3, 3*a*.
1893. Phylloporina corticosa. Ulrich, Geol. Minnesota, III, p.
Trenton (Black River): Cannon Falls and St. Paul, Minn

Phylloporina dawsoni Ulrich.

1890. Phylloporina dawsoni. Ulrich, Geol. Sur. Illinois, VIII, p.
1889. Subretepora dawsoni. (Ulrich, in press), Miller, North Pal., p. 326.
Trenton: Montreal, Canada; Chimney Point, Vermont.

Phylloporina fenestrata (Hall).

1850. Retepora fenestrata. Hall, Third Ann. Rep. State Cabin 178, pl. ii, 1*a–e*.
1889. Subretepora fenestrata. Miller, North American Geol. P
Trenton: Lowville, Lewis County, New York.

Phylloporina gracilis (Hall).

1847. Retepora gracilis. Hall, Pal. New York, I, p. 15, pl. iv,
1889. Subretepora gracilis. Miller, North American Geol. Pal.,
Chazy: Chazy, New York.

Phylloporina granistriata Ulrich.

1890. Phylloporina granistriata. Ulrich, Geol. Sur. Illinois, VIII 3, 3*a*.
Trenton: Alexander County, Illinois; Lexington, Kentuc

Phylloporina halli Ulrich.

1890. Phylloporina halli. Ulrich, Jour. Cincinnati Soc. Nat. H fig. 7.
1893. Phylloporina halli. Geol. Minnesota, III, p. 211, pl. iv,
Trenton (Black River): St. Paul, Minnesota.

Phylloporina incepta (Hall).

1847. Retepora incepta. Hall, Pal. New York, I, p. 15, pl. iv,
1889. Subretepora incepta. Miller, North American Geol. Pal.,
Chazy: Galway, Saratoga County, New York.

Phylloporina reticulata (Hall).

1847. Intricaria ? reticulata. Hall, Pal. New York, I, p. 77, pl.
1889. Subretepora reticulata. Miller, North American Geol. Pal
1890. Phylloporina reticulata. Geol. Sur. Illinois, VIII, pp. 332,

porina reticulata (Hall)—Continued.

)3. Phylloporina reticulata. Geol. Minnesota, III, p. 210, pl. iv, 8–15.
Trenton (Black River and Trenton): Watertown, New York; various localities in New York, Vermont, Minnesota and Canada.

porina sublaxa Ulrich.

)0. Phylloporina sublaxa. Ulrich, Jour. Cincinnati Soc. Nat. Hist., XII, p. 179, fig. 6.
)3. Phylloporina sublaxa. Ulrich, Geol. Minnesota, III, p. 209, pl. iv, 1–7.
Trenton (Stones River): Minneapolis, Minnesota; Lebanon, Lavergne and Murfreesboro, Tennessee.

porina trentonensis (Nicholson).

75. Retepora Trentonensis. Nicholson, Geol. Mag., new ser., II, p. 37, pl. ii, 4–4*b*.
75. Retepora Trentonensis. Nicholson, Pal. Province Ontario, p. 15, pl. ii, 4–4*b*.
39. Phylloporina trentonensis. Ulrich, Contr. Micro-Pal. Cambro-Sil., Part II, p. 47.
39. Subretepora trentonensis. Miller, North American Geol. Pal., p. 326.
)0. Phylloporina trentonensis. Ulrich, Geol. Sur. Illinois, VIII, p. 640, pl. liii, 1–1*c*.
)7. Phylloporina trentonensis. Whiteaves, Pal. Foss., III, p. 162.
Trenton: Peterborough, Ontario; St. Andrews, Manitoba.

porina variolata (Ulrich).

32. Phyllopora variolata. Ulrich, Jour. Cincinnati Soc. Nat. Hist., V, p. 160, pl. vi, 14.
39. Subretepora variolata. Miller, North American Geol. Pal., p. 326.
)0. Phylloporina variolata. Ulrich, Geol. Sur. Illinois, VIII, p. 639.
Cincinnati (Utica): Cincinnati, Ohio, and vicinity.

rypa Hall. See Eridopora Ulrich.

rypa bistriata Simpson. See Buskopora bistriata (Hall).

rypa clivulata Simpson. See Eridopora ? clivulata (Hall).

rypa denticulata Simpson. See Eridopora denticulata (Hall).

rypa geometrica Simpson. See Fistulipora geometrica (Hall).

rypa granifera Simpson. See Fistulipora granifera (Hall).

rypa pyriformis Simpson. See Buskopora pyriformis (Hall).

COTRYPA Ulrich. Genotype: Fistulipora elegans Rominger.

)0. Pinacotrypa. Ulrich, Geol. Sur. Illinois, VIII, p. 384.
39. Pinacotrypa. (Ulrich, in press), Miller, North American Geol. Pal., p. 315.
)7. Pinacotrypa. Simpson, Fourteenth Ann. Rep. State Geologist New York for the year 1894, p. 555.
)7. Fistuliporina. Simpson, Fourteenth Ann. Rep. State Geologist New York for the year 1894, p. 555.
)9. Fistuliporina. Grabau, Bull. Buffalo Soc. Nat. Sci., VI, p. 168.
)7. Fistulicella. Simpson, Fourteenth Ann. Rep. State Geologist New York for the year 1894, p. 606.
)9. Fistulicella. Grabau, Bull. Buffalo Soc. Nat. Sci., VI, p. 167.

trypa elegans (Rominger).

36. Fistulipora elegans. Rominger, Proc. Acad. Nat. Sci. Philadelphia, p. 122.
)0. Pinacotrypa elegans. Ulrich, Geol. Sur. Illinois, VIII, p. 385.

Pinacotrypa elegans (Rominger)—Continued.

1898. Pinacotrypa elegans. Whiteaves, Contr. Canadian Pal., I, p. 38
1879. Fistulipora proporoides. Nicholson, Pal. Tabulate Corals, p. 3
pl. xv, 2, 2*a*.
Hamilton: Hamburg and Canandaigua, New York.
Obs. Some of the Hamilton forms described by Hall will u
prove to be synonyms of this species.

Pinacotrypa marginata Whiteaves.

1892. Pinacotrypa marginata. Whiteaves, Contr. Canadian Pal., I,
xxxvi, 1–1*b*.
Devonian [Hamilton?]: Lake Winnepegosis, Manitoba.

Pinacotrypa operculata (Hall and Simpson).

1887. Lichenalia operculata. Hall and Simpson, Pal. New York, VI,
1888. Lichenalia operculata. Hall, Seventh Ann. Rep. State Geo
York for the year 1887, pl. xv, 7; Forty-first Ann. Rep. New
Museum, pl. xv, 7.
1897. Fistulipora operculata. Simpson, Fourteenth Ann. Rep. Stat
New York for the year 1894, pl. xxii, 13.
Hamilton: York and near Le Roy, New York.

Pinacotrypa plana (Hall).

1883. Thallostigma plana. Hall, Trans. Albany Institute, X, p. 18
1881, p. 187).
1884. Thallostigma plana. Hall, Rep. State Geologist New York f
1883, p. 30.
1887. Fistulipora plana. Hall and Simpson, Pal. New York, VI,
lviii, 19, 20.
1897. Fistulicella plana. Simpson, Fourteenth Ann. Rep. State Ge
York for the year 1894, pl. xxii, 4.
1899. Fistulicella plana. Grabau, Bull. Buffalo Soc. Nat. Sci., VI, p.
Hamilton: Darien Center and Eighteen-Mile Creek, New York.

Pinacotrypa serrulata (Hall).

1883. Thallostigma serrulata. Hall, Trans. Albany Institute,
(abstract, 1881, p. 185).
1884. Thallostigma serrulata. Hall, Rep. State Geologist New Yo
year 1883, p. 20.
1887. Fistulipora serrulata. Hall and Simpson, Pal. New York, V
lviii, 6–8.
1897. Fistuliporina serrulata. Simpson, Fourteenth Ann. Rep. Stat
New York for the year 1894, pl. xxi, 15.
Hamilton: West Bloomfield, New York.

Pinacotrypa stellata (Hall).

1883. Lichenalia stellata. Hall, Trans. Albany Institute, X, p. 18
1881, p. 183).
1884. Lichenalia stellata. Hall, Rep. State Geologist New York f
1883, p. 33.
1887. Lichenalia stellata. Hall and Simpson, Pal. New York, VI,
lviii, 15, 16.
1897. Fistuliporina stellata. Simpson, Fourteenth Ann. Rep. Stat
New York for the year 1894, pl. xxi, 9.
1898. Lichenalia stellata. Whiteaves, Contr. Canadian Pal., I, p. 38
1899. Lichenalia stellata. Grabau, Bull. Buffalo Soc. Nat. Sci., VI,
66 A.
Hamilton: West Bloomfield and Eighteen-Mile Creek, New Y

eotrypa variapora (Hall).

383. Thallostigma variapora. Hall, Trans. Albany Institute, X, p. 184 (abstract, 1881, p. 184).

384. Thallostigma variapora. Hall, Rep. State Geologist New York for the year 1883, p. 18.

387. Fistulipora variapora. Hall and Simpson, Pal. New York, VI, p. 210, pl. lviii, 9–14.

397. Fistuliporina variopora. Simpson, Fourteenth Ann. Rep. State Geologist New York for the year 1894, pl. xxi, 10.

398. Fistulipora variapora. Whiteaves, Contr. Canadian Pal., I, p. 380.
Hamilton: West Williams, Ontario; York and shore of Lake Canandaigua, New York.

aporella Simpson (1895). See Ptiloporina Hall.

aporella Simpson (1897). See Ptiloporella Hall.

aporina Simpson. See Ptiloporina Hall.

aporina pinnata Simpson. See Ptiloporina pinnata (Hall).

ATOPORA Vine. Genotype: Glauconome elegans Young and ung.

383. Pinnatopora. Vine, Rep. Brit. Assoc. Adv. Sci., LIII, p. 191.

384. Pinnatopora. Vine, Quar. Jour. Geol. Soc. London, XL, p. 330.

384. Pinnatopora. Shrubsole, Proc. Chester Soc. Nat. Hist., p. 100.

385. Pinnatopora. Vine, Proc. Yorkshire Geol. Polyt. Soc., IX, p. 78.

386. Pinnatopora. Ulrich, Contr. American Pal., I, p. 6.

390. Pinnatopora. Ulrich, Geol. Sur. Illinois, VIII, pp. 397, 614.

396. Pinnatopora. Ulrich, Zittel's Textb. Pal. (Engl. ed.), p. 283.
Glauconome of various authors.

387. Glauconome (not of Goldfuss or Lonsdale). Hall and Simpson, Pal. New York, VI, p. xxiv.

387. Glauconome (not of Goldfuss or Lonsdale). Foerste, Bull. Sci. Lab. Denison Univ., II, p. 78.

397. Glauconome (not of Goldfuss or Lonsdale). Simpson, Fourteenth Ann. Rep. State Geologist New York for the year 1894, p. 524.

399. Glauconome (not of Goldfuss or Lonsdale). Grabau, Bull. Buffalo Soc. Nat. Sci., VI, p. 176.

atopora bellula Ulrich.

390. Pinnatopora bellula. Ulrich, Geol. Sur. Illinois, VIII, p. 619, pl. lxvi, 8–8*b*.
Base of Coal Measures: Seville, Illinois.

atopora carinata (Hall).

383. Glauconome carinata. Hall, Trans. Albany Institute, X, p. 196 (abstract, 1881, p. 196).

384. Glauconome carinata. Hall, Rep. State Geologist New York for the year 1883, p. 60.

387. Glauconome carinata. Hall and Simpson, Pal. New York, VI, p. 273, pl. lxvi, 23, 24.

397. Glauconome carinata. Simpson, Fourteenth Ann. Rep. State Geologist New York for the year 1894, pl. viii, 14, 15.

399. Glauconome carinata. Grabau, Bull. Buffalo Soc. Nat. Sci., VI, p. 177, fig. 74.
Hamilton: Eighteen-Mile Creek, Erie and Ontario counties, New York.

Pinnatopora conferta Ulrich.

1890. Pinnatopora conferta. Ulrich, Geol. Sur. Illinois, VIII, p. 6
pl. lxvi, 6.
1894. Pinnatopora conferta. Keyes, Missouri Geol. Sur., V, p. 31.
Keokuk: Keokuk and Bentonsport, Iowa; Jersey County, Ill

Pinnatopora curvata Ulrich.

1888. Pinnatopora curvata. Ulrich, Bull. Denison Univ., IV, p. 7
Waverly: Richfield, Ohio.

Pinnatopora flexuosa Ulrich.

1890. Pinnatopora flexuosa. Ulrich, Geol. Sur. Illinois, VIII, p.
4–4c.
Keokuk: Kings Mountain, Kentucky.

Pinnatopora intermedia Ulrich.

1888. Pinnatopora intermedia. Ulrich, Bull. Denison Univ., IV
xiv, 1.
Waverly: Richfield, Ohio.

Pinnatopora minor Ulrich.

1888. Pinnatopora minor. Ulrich, Bull. Denison Univ., IV, p. 77,
Waverly: Richfield, Ohio.

Pinnatopora nereidis (White).

1874. Glauconome nereidis. White, Prel. Rep. Invert. Foss., p. 18
1877. Glauconome nereidis. White, Wheeler's U. S. Geol. Sur., I
vii, 5*a*–*e*.
Carboniferous: Confluence White Mountain and Black rivers,

Pinnatopora nodata (Hall).

1883. Glauconome nodata. Hall, Trans. Albany Institute, X, p. 1
1881, p. 18).
1883. Glauconome nodata. Hall, Rep. State Geologist New York
1882, pl. xxvi, 13, 14.
1887. Glauconome nodata. Hall and Simpson, Pal. New York, V
xxxiii, 13, 14.
Upper Helderberg: Near Le Roy, New York.

Pinnatopora simulatrix Ulrich.

1888. Pinnatopora simulatrix. Ulrich, Bull. Denison Univ., IV, p.
Waverly: Richfield, Ohio.

Pinnatopora sinuosa (Hall).

1883. Glauconome sinuosa. Hall, Trans. Albany Institute, X, p. 1
1881, p. 18).
1883. Glauconome sinuosa. Hall, Rep. State Geologist New York
1882, pl. xxvi, 11, 12.
1887. Glauconome sinuosa. Hall and Simpson, Pal. New York, V
xxxiii, 11, 12.
1897. Glauconome sinuosa. Simpson, Fourteenth Ann. Rep. Sta
New York for the year 1894, pl. viii, 8–10.
Upper Helderberg: Near Buffalo, New York.

Pinnatopora striata Ulrich.

1890. Pinnatopora striata Ulrich. Geol. Sur. Illinois, VIII, p. 617, p
Keokuk: Bentonsport, Iowa.

Pinnatopora subangulata Ulrich.

1888. Pinnatopora subangulata. Ulrich, Bull. Denison Univ., IV, p.
Waverly: Cuyahoga Falls, Ohio.

nnatopora tenuiramosa Ulrich.
1888. Pinnatopora tenuiramosa. Ulrich, Bull. Denison Univ., IV, p. 79.
1890. Pinnatopora tenuiramosa. Ulrich, Geol. Sur. Illinois, VIII, p. 619, pl. lxvi, 7.
Waverly: Richfield, Ohio.

nnatopora tenuistriata (Hall).
1883. Glauconome tenuistriatus. Hall, Trans. Albany Institute, X, p. 160 (abstract, 1881, p. 19).
1883. Glauconome tenuistriatus. Hall, Rep. State Geologist New York for the year 1882, pl. xxvi, 15–19.
1887. Glauconome tenuistriatus. Hall and Simpson, Pal. New York, VI, p. 102, pl. xxxiii, 15–19.
1897. Glauconome tenuistriatus. Simpson, Fourteenth Ann. Rep. State Geologist New York for the year 1894, pl. viii, 11–13.
Upper Helderberg: Near Buffalo, New York.

nnatopora trilineata (Meek).
1872. Glauconome trilineata. Meek, Pal. Eastern Nebraska, p. 157, pl. vii, *4a–d*.
1890. Pinnatopora trilineata. Ulrich, Geol. Sur. Illinois, VIII, p. 620, pl. lvi, 6.
1894. Pinnatopora trilineata. Keyes, Missouri Geol. Sur., V, p. 31.
Upper Coal Measures: Nebraska City, Nebraska; Sangamon County, Illinois; Kansas City, Missouri.

nnatopora vinei Ulrich.
1888. Pinnatopora vinei. Ulrich, Bull. Denison Univ., IV, p. 77, pl. xiv, 5.
1890. Pinnatopora vinei. Ulrich, Geol. Sur. Illinois, VIII, p. 616, pl. lxvi, 5–*5b*.
1894. Pinnatopora vinei. Keyes, Missouri Geol. Sur., V, p. 31.
Waverly: Richfield, Ohio.
Keokuk: Keokuk, Iowa; Kings Mountain, Kentucky.

nnatopora whitei Foerste.
1887. Glauconome whitii. Foerste, Bull. Sci. Lab. Denison Univ., II, p. 78.
1887. Pinnatopora whitii. Foerste, Bull. Sci. Lab. Denison Univ., II, p. 87, pl. vii, *4a–c*.
Coal Measures: Flint Ridge, Ohio.

nnatopora youngi Ulrich.
1888. Pinnatopora youngi. Ulrich, Bull. Denison Univ., IV, p. 78, pl. xiv, 6, *6a*.
1890. Pinnatopora youngi. Ulrich, Geol. Sur. Illinois, VIII, p. 615, pl. lxvi, 3.
1894. Pinnatopora youngi. Keyes, Missouri Geol. Sur., V, p. 31.
Waverly: Richfield and Lodi, Ohio.
Keokuk: Keokuk, Iowa; King's Mountain, Kentucky.

LYPORA McCoy. Genotype: Polypora dendroides McCoy.
1845. Polypora. McCoy, Synopsis Carbon. Foss. Ireland, p. 206.
1850. Polypora. D'Orbigny, Prodr. de Paleontologie, I, p. 45.
1852. Polypora. Hall, Pal. New York, II, p. 167.
1854. Polypora. McCoy, Brit. Pal. Foss., p. 115.
1860. Polypora. Eichwald, Lethæa Rossica, I, p. 372.
1874. Polypora. Nicholson, Pal. Province, Ontario, p. 98.
1875. Polypora. Etheridge, Jun., Proc. Geol. Assoc., IV, p. 120.
1881. Polypora. Vine, Rep. British Assoc. Adv. Sci., p. 170.
1882. Polypora. Ulrich, Jour. Cincinnati Soc. Nat. Hist., V, p. 150.
1883. Polypora. Claypole, Quar. Jour. Geol. Soc. London, XXXIX, p. 31.
1885. Polypora. Hall, Rep. State Geologist New York for the year 1884, p. 35.
1885. Polypora. Vine, Proc. Yorkshire Geol. Polyt. Soc., IX, p. 86.
1885. Polypora. Waagen and Pichl, Pal. Indica, Ser. XIII, pp. 774, 781.

POLYPORA McCoy—Continued.

1886. Polypora. Ulrich, Contr. American Pal., I, p. 5.
1887. Polypora. Foerste, Bull. Sci. Lab. Denison Univ., II, p. 82.
1887. Polypora. Hall and Simpson, Pal. New York, VI, p. xxiv.
1889. Polypora. Miller, North American Geol. Pal., p. 315.
1890. Polypora. Ulrich, Geol. Sur. Illinois, VIII, pp. 396, 585.
1894. Polypora. Počta, Syst. Sil. Bohême, VIII, t. I, p. 84.
1895. Polypora. Simpson, Thirteenth Ann. Rep. State Geologist N the year 1893, pp. 699, 724; Forty-seventh Ann. Rep. New Museum, pp. 893, 918.
1895. Polypora. Whidborne, Devon. Fauna England, (Pal. Soc. I II, Part 4, p. 174.
1896. Polypora. Ulrich, Zittel's Textb. Pal. (Engl. ed.), p. 282.
1897. Polypora. Simpson, Fourteenth Ann. Rep. State Geologis for the year 1894, pp. 502, 520.
1899. Polypora. Grabau, Bull. Buffalo Soc. Nat. Sci., VI, p. 162.
1895. Polyporella. Simpson, Thirteenth Ann. Rep. State Geologi for the year 1893, pp. 700, 725; Forty-seventh Ann. Rep State Museum, pp. 894, 919.
1897. Polyporella. Simpson, Fourteenth Ann. Rep. State Geologis for the year 1894, pp. 502, 520.
1895. Flabelliporella. Simpson, Thirteenth Ann. Rep. State Geolog for the year 1893, pp. 703, 725; Forty-seventh Ann. Rep State Museum, pp. 897, 919.
1897. Flabelliporella. Simpson, Fourteenth Ann. Rep. State Geolog for the year 1894; pp. 502, 521.
1876. Protoretepora. De Koninck, Rech. sur les Foss. Pal. de la du Sud, III, p. 176; 1898, Engl. translation, Mem. Geol. Su Wales, Pal. No. 6, p. 136.

Polypora aculeata (Hall).

1883. Fenestella aculeata. Hall, Trans. Albany Institute, X, p. 1881, p. 21).
1883. Fenestella (Polypora) aculeata. Hall, Rep. State Geologis for the year 1882, pl. xxviii, 5–7.
1886. Fenestella (Polypora) aculeata. Hall, Fifth Ann. Rep. St New York for the year 1885, pl. xl, 6–11.
1887. Fenestella (Polypora) aculeata. Hall and Simpson, Pal. Ne p. 157, pl. xxxv, 5–7, pl. xl, 6–11.
Hamilton: Falls of the Ohio.

Polypora albionensis Spencer. Recognizable?

1884. Polypora (Fenestella?) albionensis. Spencer, Trans. St. Lou IV, p. 605, pl. vii, 5, 5*a*.
1884. Polypora (Fenestella?) albionensis. Spencer, Bull. Museum Missouri, I, p. 55, pl. vii, 5, 5*a*.
Niagara: Six miles east of Hamilton, Ontario.

Polypora approximata Ulrich.

1859. Polypora biarmica (not of Keyserling). Prout, Trans. St. Sci., I, p. 450.
1890. Polypora approximata. Ulrich, Geol. Sur. Illinois, VIII, p. 5, 5*a*.
Chester: Chester, Illinois; Sloans Valley and Litchfield, Ke

pora arkonensis Miller.

874. Polypora tuberculata (not of Prout). Nicholson, Geol. Mag., new ser., I, p. 162, pl. ix, 20.

874. Polypora tuberculata (not of Prout). Nicholson, Pal. Province Ontario, p. 100, fig. 37*a–c*.

883. Polypora arkonensis. Miller, American Pal. Foss., edition 2, p. 292.

898. Polypora Arkonensis. Whiteaves, Contr. Canadian Pal., I, p. 379.

Hamilton: Arkona, Ontario.

pora arta (Hall).

879. Fenestella Arta. Hall, Thirty-second Ann. Rep. New York State Museum, p. 163 (reprint, 1880, p. 25).

883. Fenestella Arta. Hall, Rep. State Geologist New York for the year 1882, pl. xviii, 4–9 (in part).

887. Fenestella (Polypora) Arta. Hall and Simpson, Pal. New York, VI, p. 63, pl. xviii, 4–7.

888. Fenestella (Polypora) Arta. Hall, Seventh Ann. Rep. State Geologist New York for the year 1887, pl. xiv, 1–3; Forty-first Ann. Rep. New York State Museum, pl. xiv, 1–3.

Lower Helderberg: Catskill Creek, New York.

pora aspectans (Hall).

884. Fenestella aspectus. Hall, Thirty-sixth Ann. Rep. New York State Museum, p. 59.

885. Polypora aspectans. Hall, Rep. State Geologist New York for the year 1884, pl. i, 4.

887. Fenestella (Polypora) aspectans. Hall, Sixth Ann. Rep. State Geologist New York for the year 1886, p. 65.

888. Fenestella (Polypora) aspectans. Hall, Seventh Ann. Rep. State Geologist New York for the year 1887, pl. xiii, 10–14; Forty-first Ann. Rep. New York State Museum, pl. xiii, 10–14.

897. Polypora aspectans. Simpson, Fourteenth Ann. Rep. State Geologist New York for the year 1894, pl. i, 12, 13.

Hamilton: Bellona, New York.

ypora biarmica Prout (not of Keyserling). See Polypora approx-
ata Ulrich.

pora biseriata Ulrich.

890. Polypora biseriata. Ulrich, Geol. Sur. Illinois, VIII, p. 592, fig. 5*d* (p. 315), pl. lx, 4–4*b*.

894. Polypora biseriata (?). Keyes, Missouri Geol. Sur., V, p. 29.

Warsaw: Warsaw and Monroe County, Illinois; Barrett Station, Missouri (Keyes).

pora blandida Ulrich.

886. Polypora blandida. Ulrich, Contr. American Pal., I, p. 18, pl. ii, 3, 3*a*.

Hamilton: Falls of the Ohio.

pora brevisulcata (Hall).

883. Fenestella brevisulcata. Hall, Trans. Albany Institute, X, p. 168 (abstract, 1881, p. 26).

886. Fenestella (Polypora) brevisulcata. Hall, Fifth Ann. Rep. State Geologist New York for the year 1885, pl. xl, 12–15.

887. Fenestella (Polypora) brevisulcata. Hall and Simpson, Pal. New York, VI, p. 168, pl. xl, 12–15.

Upper Helderberg: Walpole, Ontario.

Polypora burlingtonensis Ulrich.

1890. Polypora burlingtonensis. Ulrich, Geol. Sur. Illinois, VIII, 2, 2*a*.

Burlington: Burlington, Iowa; Henderson County, Illinois.

Polypora carinella (Hall and Simpson).

1883. Fenestella (Polypora) n. sp. (?). Hall, Rep. State Geologi for the year 1882, pl. xxxiii, 1, 2.

1887. Fenestella (Polypora) carinella. Hall and Simpson, Pal. N p. 153, pl. xlii, 1, 2.

Upper Helderberg: Near Buffalo, New York.

Polypora celsipora (Hall).

1883. Fenestella celsipora. Hall, Trans. Albany Institute, X, p. 1881, p. 24).

1883. Fenestella (Polypora) celsipora. Hall, Rep. State Geologist the year 1882, pl. xxxiii, 5–8, ? 9, 10.

1886. Fenestella (Polypora) celsipora. Hall, Fifth Ann. Rep. S New York for the year 1885, pl. xli, 16–22, pl. xlii, 5–10.

1887. Fenestella (Polypora) celsipora. Hall and Simpson, Pal. N p. 150, pl. xli, 16–22, pl. lii, 5–10.

Upper Helderberg: Walpole, Ontario.

Polypora celsipora-minima (Hall).

1883. Fenestella celsipora var. minima. Hall, Trans. Albany Insti (abstract, 1881, p. 24).

1883. Fenestella (Polypora) celsipora. Hall, Rep. State Geologi for the year 1882, pl. xxviii, 1–4.

1886. Fenestella (Polypora) celsipora var. minima. Hall, Fifth A Geologist New York for the year 1885, pl. xli, 11–13.

1887. Fenestella (Polypora) celsipora var. minima. Hall and New York, VI, p. 151, pl. xxxv, 1–4, pl. xli, 11–13.

Hamilton: Falls of the Ohio.

Polypora celsipora-minor (Hall).

1883. Fenestella celsipora var. minor. Hall, Trans. Albany Insti (abstract, 1881, p. 24).

1886. Fenestella (Polypora) celsipora var. minor. Hall, Fifth A Geologist New York for the year 1885, pl. xli, 14, 15.

1887. Fenestella (Polypora) celsipora var. minor. Hall and Sim York, VI, p. 151, pl. xli, 14, 15.

Upper Helderberg: Walpole, Ontario.

Polypora cestriensis Ulrich.

1890. Polypora cestriensis. Ulrich, Geol. Sur. Illinois, VIII, p. 5 pl. lx, 7–7*c*.

1894. Polypora cestriensis. Keyes, Missouri Geol. Sur., V, p. 29.

Chester: Chester, Kaskaskia, and near Anna, Illinois; I Sloans Valley, Kentucky.

Polypora compacta (Hall).

1879. Fenestella compacta. Hall, Thirty-second Ann. Rep. Ne Museum, p. 163 (reprint, 1880, p. 25).

1883. Fenestella compacta. Hall, Rep. State Geologist New York 1882, pl. xviii, 1–3.

1887. Fenestella (Polypora) compacta. Hall and Simpson, Pal. N p. 63, pl. xviii, 1–3, pl. xxii, 4, 5.

ypora compacta (Hall)—Continued.

1883. Fenestella (Hemitrypa) Nervia (in part). Hall, Rep. State Geologist New York for the year 1882, pl. xxii, 1–3.
Lower Helderberg: Clarksville, New York.

ypora complanata Ulrich.

1890. Polypora complanata. Ulrich, Geol. Sur. Illinois, VIII, p. 597, pl. lx, 6–6c.
Chester: Chester, Illinois.

ypora compressa (Hall).

1879. Fenestella compressa. Hall, Thirty-second Ann. Rep. New York State Museum, p. 164 (reprint, 1880, p. 26).
1887. Fenestella (Polypora) compressa. Hall and Simpson, Pal. New York, VI, p. 61, pl. xviii, 14–18.
1883. Fenestella planiramosa. Hall, Rep. State Geologist New York for the year 1882, pl. xviii, 14–18.
Lower Helderberg: Clarksville, New York.

ypora conferta (Hall).

1883. Fenestella conferta. Hall, Trans. Albany Institute, X, p. 63 (abstract, 1879, p. 7).
1882. Fenestella conferta. Hall, Eleventh Ann. Rep. Indiana Geol. Nat. Hist., p. 252.
Niagara: Waldron, Indiana.

ypora corticosa Ulrich.

1890. Polypora corticosa. Ulrich, Geol. Sur. Illinois, VIII, p. 596, pl. lx, 5–5c, pl. lxi, 1.
1894. Polypora corticosa. Keyes, Missouri Geol. Sur., V, p. 30.
Chester: Chester, Illinois.

ypora crassa Ulrich.

1890. Polypora crassa. Ulrich, Geol. Sur. Illinois, VIII, p. 603, pl. lxi, 8, 8*a*.
Upper Coal Measures: Sugar Creek, Sangamon County, Illinois.

ypora crebescens (Hall).

1886. Fenestella crebescens. Hall, Fifth Ann. Rep. State Geologist New York for the year 1885, pl. xlv, 20, 21.
1887. Fenestella (Polypora) crebescens. Hall and Simpson, Pal. New York, VI, p. 170, pl. xlv, 20, 21.
Upper Helderberg: Western New York.

ypora cultellata Hall. See Polypora shumardi Prout.

ypora cylindracea (Hall).

1883. Fenestella cylindracea. Hall, Trans. Albany Institute, X, p. 166 (abstract, 1881, p. 24).
Upper Helderberg: Near Buffalo, New York.

ypora distans (Hall).

1883. Fenestella distans. Hall, Trans. Albany Institute, X, p. 165 (abstract, 1881, p. 23).
1883. Fenestella (Polypora) distans. Hall, Rep. State Geologist New York for the year 1882, pl. xxx, 2–5, ? 6–10, 15, 16.
1886. Fenestella distans. Hall, Fifth Ann. Rep. State Geologist New York for the year 1885, pl. xliv, 7.
1887. Fenestella (Polypora) distans. Hall and Simpson, Pal. New York, VI, p. 161, pl. xxxvii, 2–10, 15, 16, pl. xliv, 7.
Upper Helderberg: Near Buffalo, New York.

Polypora distincta Ulrich.

1890. Polypora distincta. Ulrich, Geol. Sur. Illinois, VIII, p. 603
Upper Coal Measures: Springfield, Illinois.

Polypora elegans ? Hall. See Polypora idothea Hall.

Polypora elongata (Hall).

1883. Fenestella (Polypora) elongata. Hall, Rep. State Geologis
the year 1882, pl. xxxiii, 3, 4.

1887. Fenestella (Polypora) elongata. Hall and Simpson, Pal.
p. 153, pl. xlii, 3, 4.
Upper Helderberg: Onondaga Valley, New York.

Polypora eudora (Hall).

1879. Fenestella Eudora. Hall, Thirty-second Ann. Rep. New
seum, p. 165 (reprint, 1880, p. 27).

1883. Fenestella Eudora. Hall, Rep. State Geologist New Yo
1882, pl. xix, 3–10, ? 12.

1887. Fenestella (Polypora) Eudora. Hall and Simpson, Pal.
p. 58, pl. xix, 3, 4, ? 5, 6–10.
Lower Helderberg: Clarksville, New York.

Polypora fastuosa Foerste (De Koninck ?).

1887. Polypora fastuosa De Koninck. Foerste, Bull. Sci. Lab. De
p. 82, pl. vii, 9*a–d*.
Coal Measures: Flint Ridge and Bald Hill, Ohio.
Obs. It is very unlikely that Foerste's form is the specie
ninck described under the name P. fastuosa.

Polypora fistulata (Hall).

1884. Fenestella fistulata. Hall, Thirty-sixth Ann. Rep. New
seum, p. 59.

1885. Fenestella fistulata. Hall, Rep. State Geologist New Yo
1884, pl. i, 6.

1887. Fenestella (Polypora) fistulata. Hall, Sixth Ann. Rep.
New York for the year 1886, p. 64.

1888. Fenestella (Polypora) fistulata. Hall, Seventh Ann. Rep.
New York for the year 1887, pl. xii, 1–16; Forty-first
York State Museum, pl. xii, 1–16.

1895. Polyporella fistulata. Simpson, Thirteenth Ann. Rep. Stat
York for the year 1893, p. 700; Forty-seventh Ann.
State Museum, p. 894.

1897. Polyporella fistulata. Simpson, Fourteenth Ann. Rep. Stat
York for the year 1894, pl. i, 9, 10.
Hamilton: Genesee and Erie counties, New York; West Wi

Polypora flabelliformis (Hall).

1883. Fenestella flabelliformis. Hall, Trans. Albany Institute, X,
1881, p. 23).

1883. Fenestella (Polypora) flabelliformis. Hall, Rep. State Geol
for the year 1882, pl. xxx, 11, 12.

1887. Fenestella (Polypora) flabelliformis. Hall and Simpson,
VI, p. 161, pl. xxxvii, 11, 12.
Upper Helderberg: Onondaga Valley, New York. In the
Institute, X, p. 165, the locality is given as Shortsville, ne
New York.

ora ? gracilis Prout.

360. Polypora gracilis. Prout, Trans. St. Louis Acad. Sci., I, p. 580.
366. Polypora gracilis. Prout, Geol. Sur. Illinois, II, p. 422, pl. xxi, 1, 1*a*.
388. Polypora gracilis. Ulrich, Bull. Denison Univ., IV, p. 73.
390. Polypora ? gracilis. Ulrich, Geol. Sur. Illinois, VIII, p. 590, pl. lxi, 10, 10*a*.
394. Polypora gracilis. Keyes, Missouri Geol. Sur., V, p. 28.

Keokuk: Warsaw and Nauvoo, Illinois; Keokuk, Iowa; Kings Mountain, Kentucky.

Waverly: Richfield and Sciotoville, Ohio.

ora granilinea (Hall).

383. Fenestella granilinea. Hall, Trans. Albany Institute, X, p. 168 (abstract, 1881, p. 27).
386. Fenestella (Polypora) granilinea. Hall, Fifth Ann. Rep. State Geologist New York for the year 1885, pl. xl, 20–23.
387. Fenestella (Polypora) granilinea. Hall and Simpson, Pal. New York, VI, p. 154, pl. xl, 20–23.

Upper Helderberg: Walpole, Ontario.

ora halliana Prout.

360. Polypora Halliana. Prout, Trans. St. Louis Acad. Sci., I, p. 580.
366. Polypora Halliana. Prout, Geol. Sur. Illinois, II, p. 421, pl. xxi, 4–4*b*.
76–7. Protoretepora (Polypora) Halliana. De Koninck, Rech. sur les Foss. Pal. de la Nouv. Galles du Sud, III, p. 179; 1898, English translation, Mem. Geol. Sur. New South Wales, Pal. No. 6, p. 137.
390. Polypora halliana. Ulrich, Geol. Sur. Illinois, VIII, p. 587, pl. lix, 5–5*c*.
394. Polypora halliana. Keyes, Missouri Geol. Sur., V, p. 28.

Keokuk and Warsaw: Warsaw, Illinois, and Keokuk, Iowa.

pora Halliana Nicholson (not Prout) = ?

374. Polypora Halliana. Nicholson, Pal. Province Ontario, p. 99.

Upper Helderberg: Wainfleet, Ontario.

pora Hamiltonensis Prout. See Reteporina hamiltonensis (Prout).

ora hexagonalis (Hall).

383. Fenestella hexagonalis. Hall, Trans. Albany Institute, X, p. 169 (abstract, 1881, p. 27).
383. Fenestella (Polypora) hexagonalis. Hall, Rep. State Geologist New York for the year 1882, pl. xxxi, 14–20.
387. Fenestella (Polypora) hexagonalis. Hall and Simpson, Pal. New York, VI, p. 164, pl. xxxiii, 14–20.

Upper Helderberg: Walpole, Ontario.

ora hexagonalis-foraminulosa (Hall).

383. Fenestella hexagonalis var. foraminulosa. Hall, Trans. Albany Institute, X, p. 169 (abstract, 1881, p. 27).
383. Fenestella (Polypora) hexagonalis var. foraminulosa. Hall, Rep. State Geologist New York for the year 1882, pl. xxxii, 16–20.
387. Fenestella (Polypora) hexagonalis var. foraminulosa. Hall and Simpson, Pal. New York, VI, p. 165, pl. xxxix, 16–20.

Upper Helderberg: Walpole, Ontario.

ora idothea (Hall).

374. Polypora elegans (?). Hall, Twenty-sixth Ann. Rep. New York State Museum, p. 97.
379. Fenestella Idothea. Hall, Thirty-second Ann. Rep. New York State Museum, p. 166 (reprint, 1880, p. 28).

Polypora idothea (Hall)—Continued.

1883. Fenestella Idothea. Hall, Rep. State Geologist New York for the year 1882, pl. xix, 14, 15.

1887. Fenestella (Polypora) Idothea. Hall and Simpson, Pal. New York, VI, p. 60, pl. xix, 14, 15.

Lower Helderberg: Clarksville, New York.

Polypora imbricata Prout. Not recognizable.

1866. Polypora imbricata. Prout, Trans. St. Louis Acad. Sci., II, p. 412.

"Mountain Limestone:" Indiana.

Polypora impressa Ulrich.

1888. Polypora impressa. Ulrich, Bull. Denison Univ., IV, p. 72, pl. xiii, 8, 8*a*.

Waverly: Richfield, Ohio.

Polypora incepta Hall.

1852. Polypora incepta. Hall, Pal. New York, II, p. 167, pl. xlD, 5*a–f*.

1890. Polypora incepta (Hall?). Ulrich, Geol. Sur. Illinois, VIII, p. 358, pl. lv, 1.

Niagara: Lockport and Rochester, New York; Waldron, Indiana.

Polypora intermedia Prout.

1858. Polypora intermedia. Prout, Trans. St. Louis Acad. Sci., I, p. 272, pl. xv, 5, 5*a*.

Hamilton: Falls of the Ohio.

Polypora lævistriata (Hall).

1883. Fenestella (Polypora) lævistriata. Hall, Rep. State Geologist New York for the year 1882, pl. xxviii, 14–16.

1887. Fenestella (Polypora) lævistriata. Hall and Simpson, Pal. New York, VI, p. 159, pl. xxxv, 14–16.

Hamilton: Falls of the Ohio.

Polypora largissima (Hall).

1883. Fenestella largissima. Hall, Trans. Albany Institute, X, p. 164 (abstract, 1881, p. 22).

1883. Fenestella (Polypora) largissima. Hall, Rep. State Geologist New York for the year 1882, pl. xxvii, 8, 9.

1887. Fenestella (Polypora) largissima. Hall and Simpson, Pal. New York, VI, p. 156, pl. xxxiv, 8, 9.

Upper Helderberg: Central New York.

Polypora latitruncata (Hall).

1884. Fenestella latitruncata. Hall, Thirty-sixth Ann. Rep. New York State Museum, p. 58.

1887. Fenestella (Polypora) latitruncata. Hall, Sixth Ann. Rep. State Geologist New York for the year 1886, p. 68.

1888. Fenestella (Polypora) latitruncata. Hall, Seventh Ann. Rep. State Geologist New York for the year 1887, pl. xiii, 1–9; Forty-first Ann. Rep. New York State Museum, pl. xiii, 1–9.

Hamilton: Darien, New York; West Williams, Ontario.

Polypora levinodata (Hall).

1883. Fenestella levinodata. Hall, Trans. Albany Institute, X, p. 169 (abstract, 1881, p. 28).

1883. Fenestella (Polypora) levinodata. Hall, Rep. State Geologist New York for the year 1882, pl. xxxiii, 12–15.

1886. Fenestella (Polypora) levinodata. Hall and Simpson, Pal. New York, VI, p. 169, pl. xlii, 12–15.

Hamilton: Falls of the Ohio.

Polypora lilsea Hall.

1874. Polypora Lilia. Hall, Twenty-sixth Ann. Rep. New York State Museum, p. 96.

1879. Fenestella (Polypora) Lilsea. Hall, Thirty-second Ann. Rep. New York State Museum, p. 165 (reprint, 1880, p. 27).

1883. Fenestella (Polypora) Lilsea. Hall, Rep. State Geologist New York for the year 1882, pl. xviii, 19, 20.

1887. Fenestella (Polypora) Lilsea. Hall and Simpson, Pal. New York, VI, p. 62, pl. xviii, 19–22.

1883. Retepora n. sp. Hall, Rep. State Geologist New York for the year 1882, pl. xviii, 21, 22.

Lower Helderberg: Schoharie and Clarksville, New York.

Polypora maccoyana Ulrich.

1890. Polypora maccoyana. Ulrich, Geol. Sur. Illinois, VIII, p. 588, pl. lix, 3–3*d*.

1894. Polypora maccoyana. Keyes, Missouri Geol. Sur., V, p. 28.

Keokuk: Nauvoo and near Plymouth, Illinois; Keokuk and Bentonsport, Iowa.

Polypora manitobensis Whiteaves.

1892. Polypora (porosa ? var.) Manitobensis. Whiteaves, Contr. Canadian Pal., 1, p. 280, pl. xxxvi, 5.

Devonian (Hamilton ?): Lake Manitoba, Manitoba.

Polypora marginata Geinitz (not McCoy). See Polypora submarginata Meek.

Polypora mexicana Prout.

1858. Polypora Mexicana. Prout, Trans. St. Louis Acad. Sci., I, p. 270, pl. xvi, 2–2*b*.

1876–7. Protoretepora (Polypora) mexicana. De Koninck, Rech. sur les Foss. Pal. de la Nouv. Galles du Sud, III, p. 179; 1898, Engl. translation, Mem. Geol. Sur. New South Wales, Pal. No. 6, p. 137.

Permian: Jornada de Muerto, New Mexico.

Polypora multiplex (Hall).

1884. Fenestella multiplex. Hall, Thirty-sixth Ann. Rep. New York State Museum, p. 57.

1887. Fenestella (Polypora) multiplex. Hall, Sixth Ann. Rep. State Geologist New York for the year 1886, p. 66.

1888. Fenestella (Polypora) multiplex. Hall, Seventh Ann. Rep. State Geologist New York for the year 1887, pl. xi, 12–16; Forty-first Ann. Rep. New York State Museum, pl. xi, 12–16.

1899. Polypora multiplex. Grabau, Bull. Buffalo Soc. Nat. Sci., VI, p. 162, fig. 51A.

Hamilton: Moscow, Alden, and Eighteenmile Creek, New York.

Polypora mutabilis (Hall).

1883. Fenestella mutabilis. Hall, Trans. Albany Institute, X, p. 167 (abstract, 1881, p. 25).

1883. Fenestella (Polypora) mutabilis. Hall, Rep. State Geologist New York for the year 1882, pl. xxxii, 12–15.

1887. Fenestella (Polypora) mutabilis. Hall and Simpson, Pal. New York, VI, p. 166, pl. xxxix, 12–15.

Upper Helderberg: Walpole, Ontario.

Polypora nexa (Hall).

1883. Fenestella nexa. Hall, Trans. Albany Institute, X, p. 167 p. 25).

1883. Fenestella (Polypora) nexa. Hall, Rep. State Geologist Ne year 1882, pl. xxxii, 4–9.

1887. Fenestella (Polypora) nexa. Hall and Simpson, Pal. Ne 165, pl. xxxix, 4–9.

Upper Helderberg: Walpole, Ontario.

Polypora nodocarinata Ulrich.

1890. Polypora nodocarinata. Ulrich, Geol. Sur. Illinois, VIII, 9, 9*a*.

Upper Coal Measures: Crooked Creek, near Centralia, County, Illinois.

Polypora obliqua (Hall and Simpson).

1879. Fenestella Arta (in part). Hall, Thirty-second Ann. Rep. Museum, p. 163 (reprint, 1880, p. 25).

1883. Fenestella arta (in part). Hall, Rep. State Geologist Ne year 1882, pl. xviii, 8, 9.

1887. Fenestella (Polypora) obliqua. Hall and Simpson, Pal. p. 64, pl. xviii, 8, 9.

1888. Fenestella obliqua. Hall, Seventh Ann. Rep. State Geolo for the year 1887, pl. xiv, 4; Forty-first Ann. Rep. Ne Museum, pl. xiv, 4.

Lower Helderberg: Catskill, Greene County, New York.

Polypora paxillata (Hall).

1879. Fenestella paxillata. Hall, Thirty-second Ann. Rep. Ne Museum, p. 164 (reprint, 1880, p. 26).

1883. Fenestella papillata (in error). Hall, Rep. State Geologist the year 1882, pl. xviii, 10–12.

1887. Fenestella (Polypora) paxillata. Hall and Simpson, Pal. p. 65, pl. xviii, 10–12.

Lower Helderberg: Clarksville, New York.

Polypora perangulata (Hall).

1883. Fenestella perangulata. Hall, Trans. Albany Institu (abstract, 1881, p. 23).

1883. Fenestella (Polypora) perangulata. Hall, Rep. State Geolo for the year 1882, pl. xxx, 13, 14.

1887. Fenestella (Polypora) perangulata. Hall and Simpson, VI, p. 162, pl. xxxvii, 13, 14.

Upper Helderberg: Western New York.

Polypora perundata Hall. See Reteporidra perundata (H

Polypora porosa (Hall).

1883. Fenestella porosa. Hall, Trans. Albany Institute, X, p. 1881, p. 26).

1883. Fenestella (Polypora) porosa. Hall, Rep. State Geologist the year 1882, pl. xxxi, 1–6.

1887. Fenestella (Polypora) porosa. Hall and Simpson, Pal. Ne 163, pl. xxxviii, 1–6.

Upper Helderberg: Walpole, Ontario.

ypora propria (Hall).

1883. Fenestella propria. Hall, Trans. Albany Institute, X, p. 164 (abstract, 1881, p. 22).
1883. Fenestella (Polypora) propria. Hall, Rep. State Geologist New York for the year 1882, pl. xxvii, 10–13.
1887. Fenestella (Polypora) propria. Hall and Simpson, Pal. New York, VI, p. 157, pl. xxxiv, 10–13.
Upper Helderberg: Near Buffalo, New York.

ypora ? psyche Billings.

1874. Polypora Psyche. Billings, Pal. Foss., II, p. 11, figs. 1, 2.
Oriskany (Gaspé Limestone): Indian Cove, Gaspé Bay, Canada.

ypora pulchella Nicholson.

1874. Polypora pulchella. Nicholson, Geol. Mag., new ser., I, p. 161, pl. ix, 18.
1874. Polypora pulchella. Nicholson, Pal. Province Ontario, p. 99, fig. 35.
Upper Helderberg: Port Colborne, Ontario.

ypora punctostriata (Hall).

1876. Fenestella punctostriata. Hall, Twenty-eighth Ann. Rep. New York State Museum (documentary edition), pl. xii, 15, 16; ibid. (Museum edition, 1879), p. 125, pl. xii, 15, 16.
1882. Fenestella punctostriata. Hall, Eleventh Ann. Rep. Indiana Geol. Nat. Hist., p. 251, pl. xi, 15, 16.
Niagara: Waldron, Indiana.

ypora quadrangularis (Hall).

1883. Fenestella quadrangularis. Hall, Trans. Albany Institute, X, p. 163 (abstract, 1881, p. 21).
1883. Fenestella (Polypora) quadrangularis. Hall, Rep. State Geologist New York for the year 1882, pl. xxviii, 8–13, pl. xxix, 23, 24.
1886. Fenestella (Polypora) quadrangularis. Hall, Fifth Ann. Rep. State Geologist New York for the year 1885, pl. xl, 1, 2.
1887. Fenestella (Polypora) quadrangularis. Hall and Simpson, Pal. New York, VI, p. 158, pl. xxxv, 8–13, pl. xxxvi, 23, 24, pl. xl, 1, 2.
Hamilton: Falls of the Ohio.

ypora radialis Ulrich.

1888. Polypora radialis. Ulrich, Bull. Denison Univ., IV, p. 74.
1890. Polypora radialis. Ulrich, Geol. Sur. Illinois, VIII, p. 591, pl. lx, 1–1*d*.
1894. Polypora radialis. Keyes, Missouri Geol. Sur., V, p. 29.
Waverly: Near Newark, and Richfield, Ohio.
Keokuk: Keokuk, Iowa.

ypora retrorsa Ulrich.

1890. Polypora retrorsa. Ulrich, Geol. Sur. Illinois, VIII, p. 591, pl. lix, 6–6*d*.
1894. Polypora retrorsa. Keyes, Missouri Geol. Sur., V, p. 29.
Keokuk: Keokuk, Iowa.

ypora rigida (Hall).

1883. Fenestella rigida. Hall, Trans. Albany Institute, X, p. 164 (abstract, 1881, p. 22).
1883. Fenestella (Polypora) rigida. Hall, Rep. State Geologist New York for the year 1882, pl. xxvii, 1–3.
1887. Fenestella (Polypora) rigida. Hall and Simpson, Pal. New York, VI, p. 155, pl. xxxiv, 1–3.
Upper Helderberg: Thompson's Lake, Albany County, New York.

Polypora rigida Prout. Not recognizable.

1866. Polypora rigida. Prout, Trans. St. Louis Acad. Sci., II, p. 4
Geological horizon and locality not given.

Polypora robusta (Hall).

1883. Fenestella robusta. Hall, Trans. Albany Institute, X, p
1881, p. 22).
1883. Fenestella (Polypora) robusta. Hall, Rep. State Geologist
the year 1882, pl. xxvii, 4–7, pl. xxx, 1, pl. xxxii, 1–3.
1887. Fenestella (Polypora) robusta. Hall and Simpson, Pal.
p. 156, pl. xxxiv, 4–7, pl. xxvii, 1–3, pl. xliii, 1, pl. xlvi, 6.
Upper Helderberg: Walpole, Ontario.

Polypora rustica (Hall and Simpson).

1887. Fenestella (Polypora) rustica. Hall and Simpson, Pal.
p. 169, pl. xliii, 10–13.
Upper Helderberg: Walpole, Ontario.

Polypora separata (Hall).

1883. Fenestella (Polypora) separata. Hall, Rep. State Geologist
the year 1882, pl. xxxii, 10, 11.
1887. Fenestella (Polypora) separata. Hall and Simpson, Pal.
p. 166, pl. xxxix, 10, 11.
Upper Helderberg: Walpole, Ontario.

Polypora shumardi Prout.

1858. Polypora Shumardii. Prout, Trans. St. Louis Acad. Sci., I
3–3*b*.
1876–77. Protoretepora (Polypora) Shumardii. De Koninck, Re
Pal. de la Nouv. Galles du Sud, III, p. 179; 1898, Engl. tr
Geol. Sur. New South Wales, Pal. No. 6, p. 137.
1885. Polypora shumardi. Hall, Rep. State Geologist New Yo
1884, p. 35, pl. i, 5.
1890. Polypora shumardi. Ulrich, Geol. Sur. Illinois, VIII, p. 58
1883. Fenestella cultellata. Hall, Trans. Albany Institute, X, p
1881, p. 21).
1883. Fenestella (Polypora) cultellata. Hall, Rep. State Geolo
for the year 1882, pl. (36) xxix, 3–22.
1886. Fenestella (Polypora) cultellata. Hall, Fifth Ann. Rep.
New York for the year 1885, pl. xli, 9.
1887. Fenestella (Polypora) cultellata. Hall and Simpson, Pal.
p. 160, pl. xxxvi, 3–22, pl. xli, 9.
Hamilton: Falls of the Ohio.

Polypora simulatrix Ulrich.

1890. Polypora simulatrix. Ulrich, Geol. Sur. Illinois, VIII, p. 5
1894. Polypora simulatrix. Keyes, Missouri Geol. Sur., V, p. 28.
Keokuk: Nauvoo, Warsaw, and Henderson County, Illinoi
Bentonsport, Iowa.

Polypora spininodata Ulrich.

1890. Polypora spininodata. Ulrich, Geol. Sur. Illinois, VIII, p.
1894. Polypora spininodata. Keyes, Missouri Geol. Sur., V, p. 29
Warsaw: Warsaw, Illinois.

Polypora spinulifera Ulrich.

1890. Polypora spinulifera. Ulrich, Geol. Sur. Illinois, VIII, p. 5
3, 3*a*, 4, 4*a*.

ora spinulifera Ulrich—Continued.

94. Polypora spinulifera. Keyes, Missouri Geol. Sur., V, p. 30.
Chester: Chester and Monroe County, Illinois.
Coal Measures: Montgomery County, Illinois; near Red Oak, Iowa.

ora stragula White.

36. Polypora biarmica (not of Keyserling). Geinitz, Carb. und Dyas in Nebraska, p. 28.
72. Polypora sp. undet. Meek, Pal. Eastern Nebraska, p. 155.
74. Polypora stragula. White, Prelim. Rep. Invert. Foss., p. 19.
77. Polypora stragula. White, Wheeler's U. S. Geol. Sur., IV, p. 108, pl. vii, 4*a*, *b*.
Carboniferous: White Mountains, Arizona (White); Nebraska (Meek).

ora striatopora (Hall).

33. Fenestella striatopora. Hall, Trans. Albany Institute, X, p. 164 (abstract, 1881, p. 23).
36. Fenestella (Polypora) striatopora. Hall, Fifth Ann. Rep. State Geologist New York for the year 1885, pl. xl, 16–19.
37. Fenestella (Polypora) striatopora. Hall and Simpson, Pal. New York, VI, p. 168, pl. xl, 16–19.
97. Polypora striatopora. Simpson, Fourteenth Ann. Rep. State Geologist New York for the year 1894, pl. i, 11, 14, 15.
Hamilton: Falls of the Ohio.

ora ? stricta (Hall and Simpson).

33. Fenestella Eudora (?). Hall, Rep. State Geologist New York for the year 1882, pl. xix, 1, 2.
37. Fenestella (Polypora) stricta. Hall and Simpson, Pal. New York, VI, p. 59, pl. xix, 1, 2.
Lower Helderberg: Clarksville, New York.

ora submarginata Meek.

36. Polypora marginata (not of McCoy). Geinitz, Carb. und Dyas in Nebraska, p. 69, pl. v, 11*a*, *b*, 12*a*, *b*.
72. Polypora submarginata. Meek, Pal. Eastern Nebraska, p. 154, pl. vii, 7*a*, *b*.
90. Polypora submarginata. Ulrich, Geol. Sur. Illinois, VIII, p. 602, pl. lxi, 6–6*b*.
94. Polypora submarginata. Keyes, Missouri Geol. Sur., V, p. 30.
Upper Coal Measures: Nebraska City, Nebraska; Macoupin County, La Salle, and Springfield, Illinois; near Red Oak, Iowa.

ora submutans (Hall).

83. Fenestella submutans. Hall, Trans. Albany Institute, X, p. 163 (abstract, 1881, p. 21).
86. Fenestella (Polypora) submutans. Hall, Fifth Ann. Rep. State Geologist New York for the year 1885, pl. xl, 3–5.
87. Fenestella (Polypora) submutans. Hall and Simpson, Pal. New York, VI, p. 167, pl. xl, 3–5.
Hamilton: Falls of the Ohio.

ora tantula (Hall).

83. Fenestella tantulus. Hall, Trans. Albany Institute, X, p. 64 (abstract, 1879, p. 8).
82. Fenestella tantulus. Hall, Eleventh Ann. Rep. Indiana Geol. Nat. Hist., p. 253.
Niagara: Waldron, Indiana.

Polypora tenella Nicholson.
1874. Polypora tenella. Nicholson, Geol. Mag., new ser., I, p. 162, p
1874. Polypora tenella. Nicholson, Pal. Province Ontario, p. 100, fig
Upper Helderberg: Wainfleet, Ontario.

Polypora transversa Ulrich.
1886. Polypora transversa. Ulrich, Contr. American Pal., I, p. 18, p
Hamilton: Falls of the Ohio.

Polypora tuberculata Prout.
1858. Polypora tuberculata. Prout, Trans. St. Louis Acad. Sci., I
xviii, 3.
1885. Polypora tuberculata. Vine, Proc. Yorkshire Geol. Polyt. So
1890. Polypora tuberculata. Ulrich, Geol. Sur. Illinois, VIII, p. 595
1894. Polypora tuberculata. Keyes, Missouri Geol. Sur., V, p. 30.
Chester: Chester, Illinois; Litchfield, Kentucky.

Polypora tuberculata Nicholson (not Prout). See Polypora
Miller.

Polypora varia (Hall).
1888. Fenestella varia (Hall). Hall, Seventh Ann. Rep. State Ge
York for the year 1887, pl. xiv, 10–12; Forty-first Ann. Re
State Museum, pl. xiv, 10–12.
Lower Helderberg: Clarksville, New York.

Polypora varsoviensis Prout.
1858. Polypora varsoviensis. Prout, Trans. St. Louis Acad. Sci., I,
3–3*b*.
1890. Polypora varsoviensis. Ulrich, Geol. Sur. Illinois, VIII, p. 593
1891. Polypora Varsouviensis (?). Whitfield, Annals New York A
p. 578.
1894. Polypora varsoviensis. Keyes, Missouri Geol. Sur., V, p. 29.
Warsaw: Barretts Station, Missouri; Warsaw, and Monroe
nois.
St. Louis or Chester (Maxville Limestone): Newtonville,
field).

Polypora whitei Ulrich.
1890. Polypora whitei. Ulrich, Geol. Sur. Illinois, VIII, p. 600, pl. l
Base of Coal Measures: Seville, Illinois.

Polypora whitei-insculpta Ulrich.
1890. Polypora whitei var. insculpta. Ulrich, Geol. Sur. Illinois,
pl. lxii, 1.
1889. Polypora whitei var. eximia (in error for insculpta). (Ulric
Miller, North American Geol. Pal., p. 317.
Upper Coal Measures: Springfield, Illinois.

Polypora whitei var. eximia Ulrich. See Polypora white
Ulrich.

Polyporella Simpson. See Polypora McCoy.

Polyporella fistulata Simpson. See Polypora fistulata (Hal

PRASOPORA Nicholson and Etheridge, Jun. Genotype:
grayæ Nicholson and Etheridge, Jun.
1877. Prasopora. Nicholson and Etheridge, Jun., Ann. Mag. Nat.
XX, p. 38.

SOPORA Nicholson and Etheridge, Jun.—Continued.

1879. Prasopora. Nicholson, Pal. Tabulate Corals, p. 324.
1881. Prasopora. Nicholson, Genus Monticulipora, pp. 102, 202.
1882. Prasopora. Ulrich, Jour. Cincinnati Soc. Nat. Hist., V, p. 153.
1883. Prasopora. Foord, Contr. Micro-Pal. Cambro-Sil., p. 10.
1887. Prasopora. Foerste, Bull. Sci. Lab. Denison Univ., II, p. 170.
1889. Prasopora. Miller, North American Geol. Pal., p. 201.
1890. Prasopora. Ulrich, Geol. Sur. Illinois, VIII, p. 371.
1893. Prasopora. Ulrich, Geol. Minnesota, III, p. 244.
1896. Prasopora (in part). Zittel's Textb. Pal. (Engl. ed.), p. 104.
1896. Prasopora. Ulrich, Zittel's Textb. Pal. (Engl. ed.), p. 273.
1897. Prasopora. Simpson, Fourteenth Ann. Rep. State Geologist New York for the year 1894, p. 586.

opora affinis Foord.

1883. Prasopora affinis. Foord, Contr. Micro-Pal. Cambro-Sil., p. 12, pl. iii, 2–2*c*.
890. Prasopora affinis. Ulrich, Geol. Sur. Illinois, VIII, fig. 7*c* (p. 318).
Trenton: Ottawa City, Canada; Cannon Falls and Berne, Minnesota.

sopora calycula Ulrich. See Aspidopora calycula (James).

opora conoidea Ulrich.

886. Prasopora conoidea. Ulrich, Fourteenth Ann. Rep. Geol. Nat. Hist. Sur. Minnesota, p. 87.
893. Prasopora conoidea. Ulrich, Geol. Minnesota, III, p. 249, pl. xvi, 11–15.
897. Prasopora conica (in error for conoidea). Simpson, Fourteenth Ann. Rep. State Geologist New York for the year 1894, fig. 170 (p. 587).
Trenton (Black River): Cannon Falls and St. Paul, Minnesota.

opora contigua Ulrich.

886. Prasopora contigua. Ulrich, Fourteenth Ann. Rep. Geol. Nat. Hist. Sur. Minnesota, p. 87.
893. Prasopora contigua. Ulrich, Geol. Minnesota, III, p. 249, pl. xvi, 24–26.
894. Prasopora contigua. J. F. James, Jour. Cincinnati Soc. Nat. Hist., XVI, p. 180.
Trenton (Black River and Trenton): Goodhue and Dakota counties, Minnesota; Covington, Kentucky; Mount Pleasant, Tennessee.

opora grandis (Ulrich).

886. Monticulipora grandis. Ulrich, Fourteenth Ann. Rep. Geol. Nat. Hist. Sur. Minnesota, p. 78.
893. Monticulipora grandis. Ulrich, Geol. Minnesota, III, p. 219, pl. xv, 1–6.
Trenton (Stones River and Trenton): Minneapolis, St. Paul, and Cannon Falls, Minnesota.

opora ? hospitalis (Nicholson).

881. Monticulipora (Prasopora) Selwynii var. hospitalis. Nicholson, Genus Monticulipora, p. 209, fig. 45.
882. Prasopora hospitalis. Ulrich, Jour. Cincinnati Soc. Nat. Hist., V, p. 237.
888. Monticulipora hospitalis. James and James, Jour. Cincinnati Soc. Nat. Hist., XI, p. 26.
888. Monticulipora hospitalis var. neglecta. James and James, Jour. Cincinnati Soc. Nat. Hist., XI, p. 27, pl. i, 3.
896. Monticulipora hospitalis var. neglecta. J. F. James, Jour. Cincinnati Soc. Nat. Hist., XVIII, p. 124.
Cincinnati (Richmond): A common form of the Richmond in Ohio, Indiana, and Illinois.

Prasopora insularis Ulrich.

1893. Prasopora insularis. Ulrich, Geol. Minnesota, III, p. 251, pl
Trenton: Cannon Falls, St. Paul, Berne, and Kenyon, Minn
Wisconsin; Decorah, Iowa.

Prasopora insularis-filmorensis Ulrich.

1893. Prasopora insularis var. filmorensis. Ulrich, Geol. Minnes
pl. xvi, 18, 19.
Trenton: Fountain and Preston, Minnesota.

Prasopora lenticularis Ulrich.

1893. Prasopora lenticularis. Ulrich, Geol. Minnesota, III, p. 253,
Trenton (Black River): St. Paul and Cannon Falls, Minnes

Prasopora lycoperdon Ulrich. See Prasopora simulatrix

Prasopora lycoperdon Vanuxem, var. Selwyni Ami. Not r

1892. Prasopora lycoperdon Vanuxem, var. Selwyni. Ami, Cana
Science, V, p. 99.
Trenton: Quebec City, Quebec.

Prasopora ? newberryi Ulrich. See Aspidopora newberryi

Prasopora nodosa Ulrich.

1882. Prasopora nodosa. Ulrich, Jour. Cincinnati Soc. Nat. Hist
xi, 1–1*b*.
1894. Prasopora nodosa. J. F. James, Jour. Cincinnati Soc. N
p. 189.
Trenton: Nashville, Tennessee; Burgin and Frankfort, Ke

Prasopora oculata Foord.

1883. Prasopora oculata. Foord, Contr. Micro-Pal. Cambro-Sil.
1–1*g*.
1893. Prasopora oculata. Ulrich, Geol. Minnesota, III, p. 252, f
Trenton: Ottawa City, Canada; Goodhue County, Minneso

Prasopora parmula Foerste. See Aspidopora parmula (F

Prasopora selwyni (Nicholson).

1879. Monticulipora (Diplotrypa) Whiteavesii (in part). Nicho
ulate Corals, p. 316.
1881. Monticulipora (Prasopora) Selwynii. Nicholson, Genus
p. 206, fig. 44.
1893. Prasopora selwyni. Ulrich, Geol. Minnesota, III, p. 250,
fig. 15*a*, *b* (p. 248).
1896. Prasopora Selwynii. Zittel's Textb. Pal. (Engl. ed.), fig.
Peronopora decipiens (Rominger)) (p. 104).
Trenton: Peterborough and Ottawa, Ontario; Cannon Fall

Prasopora simulatrix Ulrich.

1886. Prasopora simulatrix. Ulrich, Fourteenth Ann. Rep. Geol.
Minnesota, p. 85.
1893. Prasopora simulatrix. Ulrich, Geol. Minnesota, III, p. 24
1896. Prasopora simulatrix. Ulrich, Zittel's Textb. Pal. (Engl
(p. 273).
1897. Prasopora simulatrix. Simpson, Fourteenth Ann. Rep.
New York for the year 1894, figs. 171, 172 (p. 587).
1890. Prasopora lycoperdon. Ulrich, Geol. Sur. Illinois, VIII, fi
1895. Monticulipora selwynii (not of Nicholson). J. F. James, J
Soc. Nat. Hist., XVIII, p. 86.

asopora simulatrix Ulrich—Continued.

1895. Trenton (Black River and Trenton): A rather common form in the Trenton of Kentucky, Tennessee, and Wisconsin, and in the Black River and Trenton of Minnesota.

asopora simulatrix-orientalis Ulrich.

1879. Monticulipora (Diplotrypa) Whiteavesii (in part). Nicholson, Pal. Tabulate Corals, p. 316, fig. 42*c*, pl. xiv, 1.

1893. Prasopora simulatrix var. orientalis. Ulrich, Geol. Minnesota, III, p. 246, pl. xvi, 1, 2, 6, 7.

Trenton: Ottawa and Peterborough, Canada; Trenton Falls, New York.

ISMOPORA Hall. Genotype: Prismopora triquetra Hall.

1883. Prismopora. Hall, Trans. Albany Institute, X, pp. 158, 193 (abstract, 1881, p. 17).

1884. Prismopora. Hall, Rep. State Geologist New York for the year 1883, p. 50.

1884. Prismopora. Ulrich, Jour. Cincinnati Soc. Nat. Hist., VII, p. 40.

1887. Prismopora. Foerste, Bull. Sci. Lab. Denison Univ., II, p. 75.

1887. Prismopora. Hall and Simpson, Pal. New York, VI, p. xxi.

1889. Prismopora. Miller, North American Geol. Pal., p. 317.

1890. Prismopora. Ulrich, Geol. Sur. Illinois, VIII, p. 386.

1897. Prismopora. Simpson, Fourteenth Ann. Rep. State Geologist New York for the year 1894, p. 531.

ismopora dilata Hall. See Prismopora dilatata Hall.

ismopora dilatata Hall.

1883. Prismopora dilata. Hall, Trans. Albany Institute, X, p. 193 (abstract, 1881, p. 193).

1884. Prismopora dilatata. Hall, Rep. State Geologist New York for the year 1883, p. 50.

1887. Prismopora dilatata. Hall and Simpson, Pal. New York, VI, p. 265, pl. lxii, 13, 14.

1891. Prismopora dilatata. Hall, Tenth Ann. Rep. State Geologist New York for the year 1890, p. 53; Forty-fourth Ann. Rep. New York State Museum, p. 83.

Hamilton: Near Leonardsville, New York.

smopora lata Hall and Simpson.

1887. Prismopora lata. Hall and Simpson, Pal. New York, VI, p. 266.

1891. Prismopora lata. Hall, Tenth Ann. Rep. State Geologist New York for the year 1890, p. 53; Forty-fourth Ann. Rep. New York State Museum, p. 83.

Hamilton: Near Le Roy, New York.

smopora minima Ulrich.

1890. Prismopora minima. Ulrich, Geol. Sur. Illinois, VIII, p. 506, pl. lxxviii, 1–1*c*.

Lower Coal Measures: Sparta, Illinois.

smopora paucirama Hall.

1883. Prismopora paucirama. Hall, Trans. Albany Institute, X, p. 159 (abstract, 1881, p. 17).

1883. Prismopora paucirama. Hall, Rep. State Geologist New York for the year 1882, pl. xxv, 11.

1886. Prismopora paucirama. Hall, Fifth Ann. Rep. State Geologist New York for the year 1885, pl. xxix, 16, 17.

1887. Prismopora paucirama. Hall and Simpson, Pal. New York, VI, p. 98, pl. xxviii, 11, pl. xxix, 16, 17.

Upper Helderberg: Thompsons Lake, Albany County, New York.

Prismopora ? serrata (Meek).

1875. Ptilodictya (Stictopora) serrata. Meek, Pal. Ohio, II, p. 327,

1887. Prismopora serrata. Foerste, Bull. Sci. Lab. Denison Univ. vii, 6*a–c*.

Lower Coal Measures: Flint Ridge, Ohio.

Obs. This may prove the same as Cystodictya carbonaria (

Prismopora serrulata Ulrich.

1884. Prismopora serrulata. Ulrich, Jour. Cincinnati Soc. Nat. Hi pl. ii, 2–2*f*.

Chester: Sloans Valley and Grayson Springs, Kentucky.

Prismopora sparsipora (Hall).

1883. Thallostigma sparsipora. Hall, Trans. Albany Institute (abstract, 1881, p. 13).

1886. Prismopora sparsipora. Hall, Fifth Ann. Rep. State Geolog for the year 1885, pl. xxxii, 25–28.

1887. Prismopora sparsipora. Hall and Simpson, Pal. New York, xxxii, 24–27.

Hamilton: Falls of the Ohio. In the Trans. Albany Instit the locality is given as Onondaga Valley, New York.

Prismopora subtriquetra Simpson. See **Prismopora trique**

Prismopora triangulata (White).

1878. Ptilodictya triangulata. White, Proc. Acad. Nat. Sci. Philad

1879. Ptilodictya triangulata. White, Bull. U. S. Geol. Sur. Territo

1881. Ptilodictya triangulata. White, Wheeler's U. S. Geol. Sur., I p. xxiv, pl. iv, 2*a–e*.

1881. Ptilodictya triangulata. White, Twelfth Ann. Rep. U. S. Ge Territories, p. 131, pl. xxxiii, 3*a–e*.

1884. Prismopora triangulata. Ulrich, Jour. Cincinnati Soc. Nat. H

Coal Measures: Danville, Illinois.

Prismopora trifolia Ulrich. See **Phractopora trifolia** (R

Prismopora triquetra Hall.

1883. Prismopora triquetra. Hall, Trans. Albany Institute, X, p. 1881, p. 17).

1883. Prismopora triquetra. Hall, Rep. State Geologist New York 1882, pl. xxv, 8–10.

1886. Prismopora triquetra. Hall, Fifth Ann. Rep. State Geolog for the year 1885, pl. xxix, 9–15.

1887. Prismopora triquetra. Hall and Simpson, Pal. New York, xxviii, 8–10, pl. xxix, 9–15.

1897. Prismopora triquetra. Simpson, Fourteenth Ann. Rep. St New York for the year 1894, pl. xii, 9–14.

1897. Prismopora subtriquetra. Simpson, Fourteenth Ann. Rep. S New York for the year 1894, pl. xii, 15.

Hamilton: Falls of the Ohio.

PROBOSCINA Audouin. Genotype: Proboscina boryi Aud

1826. Proboscina. Audouin, Savigny's Descr. del Egypte, Pol., p.

1854. Proboscina. D'Orbigny, Pal. Francais, Terr. Cret., V, p. 844.

1854. Proboscina. Haime, Bry. Foss. Form. Juras., p. 166 (extra

1882. Proboscina. Ulrich, Jour. Cincinnati Soc. Nat. Hist., V, p. 14

1890. Proboscina. Ulrich, Geol. Sur. Illinois, VIII, p. 368.

1893. Proboscina. Ulrich, Geol. Minnesota, III, p. 119.

ROBOSCINA Audouin—Continued.

1897. Proboscina. Simpson, Fourteenth Ann. Rep. State Geologist New York for the year 1894, p. 596.

roboscina auloporoides (Nicholson).

1875. Alecto auloporoides. Nicholson, Pal. Ohio, II, p. 267, pl. xxv, 2–2*b*.
1889. Proboscina auloporoides. Ulrich, Contr. Micro-Pal. Cambro-Sil., Part II, p. 28.
1889. Stomatopora auloporoides. Miller, North American Geol. Pal., p. 325.
1895. Proboscina auloporoides. Whiteaves, Pal. Foss., III, p. 115.
Cincinnati (Lorraine and Richmond): Cincinnati, Ohio, and vicinity; Stony Mountain, Manitoba.

roboscina confusa (Nicholson).

1875. Alecto confusa. Nicholson, Pal. Ohio, II, p. 267, pl. xxv, 6.
1889. Stomatopora confusa. Miller, North American Geol. Pal., p. 325.
Cincinnati (Utica): Cincinnati, Ohio, and vicinity.

roboscina frondosa (Nicholson).

1873. Aulopora frondosa. James, Additions to Catal. Sil. Foss. Cincinnati group, p. 15. (Not defined.)
1875. Alecto frondosa. Nicholson, Pal. Ohio, II, p. 266, pl. xxv, 3–3*b*.
1889. Stomatopora frondosa. Miller, North American Geol. Pal., p. 325.
1889. Proboscina frondosa. Ulrich, Contr. Micro-Pal. Cambro-Sil., Part II, p. 28.
1893. Proboscina frondosa. Ulrich, Geol. Minnesota, III, p. 119, pl. i, 28.
1895. Proboscina frondosa. Whiteaves, Pal. Foss., III, p. 115.
1896. Stomatopora (Proboscina) frondosa. Ulrich, Zittel's Textb. Pal. (Eng. ed.), fig. 412*c* (p. 261).
1897. Proboscina frondosa. Simpson, Fourteenth Ann. Rep. State Geologist New York for the year 1894, fig. 201 (in part) (p. 596).
Cincinnati (Lorraine and Richmond): Cincinnati, Ohio, and vicinity (Lorraine); in the Richmond beds of Ohio, Indiana, Kentucky, Illinois, and at Stony Mountain, Manitoba.

roboscina ? laxa Whiteaves.

1891. Proboscina laxa. Whiteaves, Contr. Canadian Pal., I, p. 212, pl. xxviii, 9, 9*a*.
Devonian (Hamilton?): Hay River, Canada.

roboscina tumulosa Ulrich.

1893. Proboscina tumulosa. Ulrich, Geol. Minnesota, III, p. 119, pl. i, 24.
1897. Proboscina tumulosa. Simpson, Fourteenth Ann. Rep. State Geologist New York for the year 1894, fig. 201 (in part) (p. 596).
Trenton (Black River): St. Paul and Cannon Falls, Minnesota.

ROTOCRISINA Ulrich. Genotype: Protocrisina exigua Ulrich.

1890. Protocrisina. Ulrich, Geol. Sur. Illinois, VIII, p. 369.
1889. Protocrisina. (Ulrich, in press), Miller, North American Geol. Pal., p. 317.
1896. Protocrisina. Ulrich, Zittel's Textb. Pal. (Eng. ed.), p. 262.

rotocrisina exigua Ulrich.

1890. Protocrisina exigua. Ulrich, Geol. Sur. Illinois, VIII, p. 405, pl. xxix, 4–4*c*, pl. liii, 11–11*e*.
1896. Protocrisina exigua. Ulrich, Zittel's Textb. Pal. (Eng. ed.), fig. 417 (p. 262).
Trenton: Montreal, Canada; Trenton Falls, New York.
Cincinnati (Richmond): Wilmington, Illinois.

rotoretepora De Koninck. See Polypora McCoy.

Protoretepora (Polypora) Halliana De Koninck. See Polypor Prout.

Protoretepora (Polypora) mexicana De Koninck. See Polyp cana Prout.

Protoretepora (Polypora) Shumardii De Koninck. See shumardi Prout.

Protoretepora (Polypora) hamiltoniana De Koninck. See R hamiltonensis (Prout).

PROUTELLA Ulrich. Genotype: Cyclopora discoidea Prout.

1890. Proutella. Ulrich, Geol. Sur. Illinois, VIII, pp. 403, 674.
1889. Proutella. (Ulrich, in press), Miller, North American Geol.
1897. Proutella. Simpson, Fourteenth Ann. Rep. State Geologist Ne the year 1894, p. 601.

Proutella discoidea (Prout).

1860. Cyclopora discoidea. Prout, Trans. St. Louis Acad. Sci., I, p.
1866. Cyclopora discoidea. Prout, Geol. Sur. Illinois, II, p. 420, pl. pl. xxii, 10, 10*a*.
1890. Proutella discoidea. Ulrich, Geol. Sur. Illinois, VIII, p. 674, pl.
1894. Proutella discoidea. Keyes, Missouri Geol. Sur., V, p. 37.
1897. Proutella discoidea. Simpson, Fourteenth Ann. Rep. State Ge York for the year 1894, figs. 214–216 (p. 602).
Keokuk: Warsaw, Hamilton, and Nauvoo, Illinois; Keokuk,

Pteropora Hall. See Tæniopora Nicholson.

Pteropora duogeneris Hall. See Tæniopora exigua Nicholso

Ptilionella Hall. See Reptaria Rolle.

Ptilionella conferta Hall. See Hederella conferta (Hall).

Ptilionella nodata Hall. See Reptaria nodata (Hall).

Ptilionella penniformis Hall. See Reptaria stolonifera Rolle

PTILOCELLA Simpson. Genotype: Ptilodictya parallela Hal

1897. Ptilocella. Simpson, Fourteenth Ann. Rep. State Geologist Ne the year 1894, p. 605.

Ptilocella parallela (Hall and Simpson).

1887. Ptilodictya parallela. Hall and Simpson, Pal. New York, pl. lxi, 7, 8.
1891. Ptilodictya parallela. Hall, Tenth Ann. Rep. State Geologist for the year 1890, p. 54; Forty-fourth Ann. Rep. New York Stat p. 84.
1897. Ptilocella parallela. Simpson, Fourteenth Ann. Rep. State Ge York for the year 1894, pl. xv, 1–3.
Hamilton: Darien Center and near the head of Lake Canand York.

PTILODICTYA Lonsdale. Genotype: Flustra lanceolata (Goldfuss ?).

1839. Ptilodictya. Lonsdale, Murchison's Silurian System, p. 676.
1852. Ptilodictya. McCoy, Brit. Pal. Foss., p. 45.
1860. Ptilodictya. Eichwald, Lethæa Rossica, I, p. 387.
1874. Ptilodictya. Nicholson, Geol. Mag., new ser., I, p. 123.
1874. Ptilodictya. Nicholson, Pal. Province Ontario, p. 97.
1881. Ptilodictya. Vine, Rep. Brit. Assoc. Adv. Sci., p. 164.

PTILODICTYA Lonsdale—Continued.

1882. Ptilodictya. Vine, Quar. Jour. Geol. Soc. London, XXXVIII, p. 63.
1882. Ptilodictya. Ulrich, Jour. Cincinnati Soc. Nat. Hist., V, pp. 151, 162.
1883. Ptilodictya. Vine, Rep. British Assoc. Adv. Sci., p. 203.
1887. Ptilodictya. Foerste, Bull. Sci. Lab. Denison Univ., II, p. 155.
1887. Ptilodictya. Hall and Simpson, Pal. New York, VI, p. xix.
1889. Ptilodictya. Miller, North American Geol. Pal., p. 318.
1889. Ptilodictya. Nettleroth, Kentucky Fossil Shells, p. 30.
1890. Ptilodictya. Ulrich, Geol. Sur. Illinois, VIII, p. 390.
1893. Ptilodictya. Ulrich, Geol. Minnesota, III, p. 163.
1896. Ptilodictya. Ulrich, Zittel's Textb. Pal. (Engl. ed.), p. 279.
1897. Ptilodictya. Simpson, Fourteenth Ann. Rep. State Geologist New York for the year 1894, p. 541.
1899. Ptilodictya. Grabau, Bull. Buffalo Soc. Nat. Sci., VI, p. 176.
1874. Escharopora (not of Hall, 1847, Pal. New York, I, p. 72). Hall, Twenty-sixth Ann. Rep. New York State Mus., [p. 99]; Thirty-second Ann. Rep. New York State Museum, 1879, p. 161.
1875. Heterodictya. Nicholson, Geol. Mag., new ser., II, p. 33.
1875. Heterodictya. Nicholson, Pal. Province Ontario, p. 79.
1889. Heterodictya. Miller, North American Geol. Pal., p. 309.

Ptilodictya acuminata James. See Escharopora acuminata (James).

Ptilodictya acuta Nicholson. See Pachydictya acuta (Hall).

Ptilodictya alcyone Billings. See Pachydictya alcyone (Billings).

Ptilodictya angusta (Hall).

1883. Escharopora (Ptilodictya) angusta. Hall, Trans. Albany Institute, X, p. 62 (abstract, 1879, p. 6).
1882. Escharopora (Ptilodictya) angusta. Hall, Eleventh Ann. Rep. Indiana Geol. Nat. His., p. 245.
Niagara: Waldron, Indiana.

Ptilodictya antiqua James. See Eurydictya multipora (Hall).

Ptilodictya ? arctipora Nicholson. See Bythopora arctipora (Nicholson.)

Ptilodictya arguta Billings. See Pachydictya crassa (Hall).

Ptilodictya bipunctata (Van Cleve) Hall. See Phænopora expansa Hall and Whitfield.

Ptilodictya briareus Ulrich. See Escharopora briareus (Ulrich).

Ptilodictya canadensis Billings.

1866. Ptilodictya canadensis. Billings, Catal. Sil. Foss. Anticosti, p. 9.
Cincinnati (Richmond): Anticosti Island.

Ptilodictya (Stictopora) carbonaria Meek. See Cystodictya carbonaria (Meek).

Ptilodictya ? cincinnatiensis James. See Arthropora shafferi-cleavelandi (James).

Ptilodictya cleavelandi James. See Arthropora shafferi-cleavelandi (James).

Ptilodictya clintonensis James. See Ptilodictya nodosa James.

Ptilodictya cosciniformis Nicholson. See Coscinella cosciniformis (Nicholson).

Ptilodictya crassa Nicholson and Hinde. See Pachydic
(Hall).

Ptilodictya cruciformis d'Orbigny (not defined). See E
falciformis (Nicholson).

Ptilodictya (Stictopora?) dictyota Meek. See Coscinium
(Meek).

Ptilodictya dubia James. See Arthropora shafferi-cleavelan

Ptilodictya emacerata Nicholson. See Dicranopora emacera
son).

Ptilodictya ensiformis Ulrich. See Phænopora ? ensiformi

Ptilodictya excellens Billings. See Phænopora excellens (

Ptilodictya expansa Hall (in part). See Phænopora expans
Whitfield.

Ptilodictya expansa Hall.

1883. Ptilodictya expansa (in part). Hall, Twelfth Ann. Rep. I
Nat. Hist., pl. xii, 2, 3 (but not description on p. 266=Phæno
Hall and Whitfield).

1887. Ptilodictya expansa. Foerste, Bull. Sci. Lab. Denison Uni
ibid., III, 1888, pl. xv, 5.

1889. Ptilodictya expansa. Foerste, Proc. Boston Soc. Nat. Hist.,

1890. Ptilodictya expansa. Ulrich, Geol. Sur. Illinois, VIII, fig. 11

1895. Ptilodictya lanceolata var. Americana. Foerste, Geol. Su
p. 598, pl. xxxvi, 3*a*–*b*.

Clinton: Dayton and Todds Fork, Ohio; Cumberland Ga
(Foerste).

Ptilodictya expansa-emarcescens Foerste.

1889. Ptilodictya expansa var. emarcescens. Foerste, Proc. Bos
Hist., XXIV, p. 328, pl. vi, 30.

1895. Pachydictya emarcescens. Foerste, Geol. Sur. Ohio, VII, p. 59

Clinton: Eaton, Ohio.

Obs. This form may prove to be young examples of Ptilodi
Hall.

Ptilodictya explicans Safford. Not recognized.

1869. Ptilodictya explicans. Safford, Geol. Tennessee, p. 286.

Ptilodictya falciformis Nicholson. See Escharopora falcifor
son).

Ptilodictya famelicus Foerste. See Pachydictya ? famelic

Ptilodictya farctus Foerste. See Pachydictya crassa (Hall

Ptilodictya fenestelliformis Nicholson. See Pachydictya
formis (Nicholson).

Ptilodictya fimbriata James. See Phænopora fimbriata (J

Ptilodictya flagellum Nicholson.

1875. Ptilodictya flagellum. Nicholson, Ann. Mag. Nat. Hist., ser.
pl. xiv, 3–3*b*.

1875. Ptilodictya flagellum. Nicholson, Pal. Ohio, II, p. 262, pl. xx

Cincinnati (Richmond): Near Lebanon, Ohio.

Obs. Ptilodictya nodosa James may be a synonym of this s

Ptilodictya flexuosa James. See Stictoporella flexuosa (Ja

Ptilodictya fragilis Billings. See Dicranopora fragilis (Billings).

Ptilodictya gigantea (Nicholson).

1875. Heterodictya gigantea. Nicholson, Geol. Mag., new ser., II, p. 34, pl. ii, 1*a–e*.
1875. Heterodictya gigantea. Nicholson, Pal. Province Ontario, p. 79, pl. ii, 1*a–e*.
1882. Ptilodictya (Heterodictya) gigantea. Ulrich, Jour. Cincinnati Soc. Nat. Hist., V, p. 140.
1889. Heterodictya gigantea. Miller, North American Geol. Pal., fig. 488 (p. 309).
Upper Helderberg: Jarvis, Ontario.

Ptilodictya Gilberti Nicholson. See Cystodictya gilberti (Meek).

Ptilodictya (Stictopora) Gilberti Meek. See Cystodictya gilberti (Meek).

Ptilodictya gladiola Billings.

1866. Ptilodictya gladiola. Billings, Catal. Sil. Foss. Anticosti, p. 10.
Anticosti: Anticosti Island.

Ptilodictya grahami James. See Arthropora shafferi-cleavelandi (James).

Ptilodictya granulosa James. See Rhinidictya parallela (James).

Ptilodictya hilli James. See Escharopora hilli (James).

Ptilodictya internodia Miller and Dyer. See Dicranopora internodia (Miller and Dyer).

Ptilodictya kentuckyensis James.

1881. Ptilodictya kentuckyensis. James, Paleontologist, No. 5, p. 38.
Cincinnati: Cincinnati, Ohio.
Obs. Description given is not sufficient to identify the species. The form may perhaps be a synonym of Arthropora shafferi-cleavelandi (James).

Ptilodictya lanceolata var. Americana Foerste. See Ptilodictya expansa Hall.

Ptilodictya libana Safford. See Escharopora libana (Safford).

Ptilodictya (Stictopora) lichenoides Meek. Not recognizable.

1873. Ptilodictya (Stictopora) lichenoides. Meek, Pal. Ohio, I, p. 195, pl. xviii, 2.
Corniferous: Whitehouse, Lucas County, Ohio.

Ptilodictya lirata Hall and Simpson. See Phænopora lirata (Hall).

Ptilodictya maculata Ulrich. See Escharopora maculata (Ulrich).

Ptilodictya magnifica Miller.

1878. Ptilodictya magnifica. Miller, Jour. Cincinnati Soc. Nat. Hist., I, p. 100, pl. iii, 1, 1*a*.
1889. Ptilodictya magnifica. Miller, North American Geol. Pal., fig. 503, (p. 318).
1890. Ptilodictya magnifica. Ulrich, Geol. Sur. Illinois, VIII, fig. 11*a–c* (p. 391).
Cincinnati (Richmond): Richmond, Indiana; Oxford and Waynesville, Ohio; Wilmington, Illinois; Leipers Creek, Maury County, Tennessee.

Ptilodictya Meeki Nicholson. See Cystodictya meeki (Nicholson).

Ptilodictya multiramis Safford. Not recognized.

1869. Ptilodictya multiramis. Safford, Geol. Tennessee, p. 286.
Obs. See note on Escharopora briareus Ulrich.

Ptilodictya nebulosa (Hall).

1874. Escharopora nebulosa. Hall, Twenty-sixth Ann. Rep. New
Museum, p. 99.
1879. Escharopora nebulosa. Hall, Thirty-second Ann. Rep. New
Museum, p. 162 (reprint, 1880, p. 24).
1883. Escharopora (Ptilodictya) nebulosa. Hall, Rep. State Geologi
for the year 1882, pl. xvii, 14–16.
1887. Ptilodictya nebulosa. Hall and Simpson, Pal. New York, V
xvii, 13–18.
1874. Paleschara bifoliata. Hall, Twenty-sixth Ann. Rep. New
Museum, p. 107.
1879. Escharopora (? Paleschara) bifoliata. Hall, Thirty-second An
York State Museum, p. 162 (reprint, 1880, p. 24).
1883. Paleschara ? foliata. Hall, Rep. State Geologist New York
1882, pl. xvii, 17, 18.
Lower Helderberg: Catskill, Clarksville, and Schoharie, New

Ptilodictya nitidula Billings. See Dicranopora nitidula (Bi

Ptilodictya nodosa James.

1879. Ptilodictya nodosa. James, Paleontologist, No. 3, p. 20.
1882. Ptilodictya nodosa. Ulrich, Jour. Cincinnati Soc. Nat. Hist.
2, 2*a*.
1881. Ptilodictya clintonensis. James, Paleontologist, No. 5, p. 38.
1881. Ptilodictya teres. James, Paleontologist, No. 5, p. 40.
1890. Ptilodictya variabilis. Ulrich, Geol. Sur. Illinois, VIII, p. 30
fig. 6*a* (p. 317).
1889. Ptilodictya variabilis. Miller, North American Geol. Pal.,
(p. 319).
Cincinnati (Richmond): Clinton and Warren counties, Ohio.
Obs. See also Ptilodictya flagellum Nicholson.

Ptilodictya obliqua (Ringueberg).

1884. Stictopora obliqua. Ringueberg, Proc. Acad. Nat. Sci. Philade
pl. ii, 2, 2*a*.
1889. Ptilodictya obliqua. Miller, North American Geol. Pal., p. 3
Clinton: Lockport, New York.
Obs. This species was defined and figured in such a mann
questionable whether it can be recognized.

Ptilodictya parallela Hall and Simpson. See Ptilocella para
and Simpson).

Ptilodictya parallela James. See Rhinidictya parallela (Jan

Ptilodictya pavonia D'Orbigny. See Escharopora pavon
bigny).

Ptilodictya perelegans Ulrich. See Graptodictya perelegan

Ptilodictya platyphylla James. See Phænopora expansa
Whitfield.

Ptilodictya plumaria James.

1878. Ptilodictya plumaria. James, Paleontologist, No. 1, p. 4.
1882. Ptilodictya plumaria. Ulrich, Jour. Cincinnati Soc. Nat. Hist
1, 1*a*.
Cincinnati (Richmond): Waynesville and Oxford, Ohio.

tilodictya plumea Hall and Simpson. See Stictoporina plumea (Hall and Simpson).

tilodictya ponderosa Ulrich.

1888. Ptilodictya ponderosa. Ulrich, American Geologist, I, p. 308.
Trenton: Covington, Kentucky.
Obs. This is a good species belonging to the genus Escharopora, but requires further description before the name can be considered valid.

tilodictya ? punctata Nicholson and Hinde. See Phænopora punctata (Nicholson and Hinde).

tilodictya ramosa Ulrich. See Escharopora ramosa (Ulrich).

tilodictya ? raripora Nicholson and Hinde. See Nematopora raripora (Hall).

tilodictya retiformis Hall and Simpson. See Stictoporina plumea (Hall and Simpson).

tilodictya rudis Foerste. See Pachydictya crassa (Hall).

tilodictya rustica Billings. See Pachydictya crassa (Hall).

tilodictya scutulata Hall and Simpson. See Stictoporina scutulata (Hall).

tilodictya (Stictopora) sereata Meek. See Prismopora? serrata (Meek).

tilodictya Shafferi Nicholson. See Arthropora shafferi (Meek).

tilodictya (Stictopora) Shafferi Meek. See Arthropora shafferi (Meek).

tilodictya subrecta Ulrich. See Escharopora subrecta (Ulrich).

tilodictya sulcata Billings.

1866. Ptilodictya sulcata. Billings, Catal. Sil. Fos. Anticosti, p. 35.
Anticosti: Anticosti Island.

tilodictya superba Billings. See Phænopora superba (Billings).

tilodictya symmetra Safford. Not recognized.

1869. Ptilodictya symmetra. Safford, Geol. Tennessee, p. 286.

tilodictya ?? tarda Billings.

1874. Ptilodictya tarda. Billings, Pal. Foss., II, p. 13.
Oriskany (Gaspé Limestone): Grand Creve, Canada.

tilodictya ? tenera Billings.

1866. Ptilodictya tenera. Billings, Catal. Sil. Foss. Anticosti, p. 33.
Anticosti: Anticosti Island.

tilodictya tenuis Hall and Simpson. See Phænopora tenuis (Hall).

tilodictya teres James. See Ptilodictya nodosa James.

tilodictya triangulata White. See Prismopora triangulata (White).

tilodictya variabilis Ulrich. See Ptilodictya nodosa James.

tilodictya (Stictopora) variabilis Prout. Not recognized; probably Cystodictya gilberti (Meek).

1866. Ptilodictya (Stictopora) variabilis. Prout, Trans. St. Louis Acad. Sci., II, p. 412.
Devonian: Columbus, Ohio.

tilodictya welshi James. See Phænopora multifida (Hall).

Ptilodictya whiteavesi Ulrich.

1889. Ptilodictya Whiteavesii. Ulrich, Contr. Micro-Pal. Cambro p. 44, pl. viii, 1–1*e*.
1895. Ptilodictya Whiteavesii. Whiteaves, Pal. Foss., III, p. 118.
Cincinnati (Richmond): Stony Mountain, Manitoba.

Ptilodictya whitfieldi Foerste.

1895. Ptilodictya Whitfieldi. Foerste, Geol. Sur. Ohio, VII, p. 5 4, pl. xxviii, 5.
Clinton: Todds Fork, Ohio.

PTILOPORA McCoy. Genotype: Ptilopora pluma McCoy.

1845. Ptilopora. McCoy, Synop. Carbon. Foss. Ireland, p. 200.
1858. Ptilopora. Hall, Pal. Iowa, p. 652.
1860. Ptilopora. Eichwald, Lethæa Rossica, I, p. 381.
1883. Ptilopora. Hall, Trans. Albany Institute, X, p. 196 (abstract,
1883. Ptilopora. Claypole, Quar. Jour. Geol. Soc. London, XXX
1885. Ptilopora. Hall, Rep. State Geologist, New York, for the ye
1885. Ptilopora. Waagen and Pichl, Pal. Indica, Ser. XIII, p. 77
1886. Ptilopora. Ulrich, Contr. American Pal., I, p. 4.
1887. Ptilopora. Hall and Simpson, Pal. New York, VI, p. xxiv.
1889. Ptilopora. Miller, North American Geol. Pal., p. 318.
1890. Ptilopora. Ulrich, Geol. Sur. Illinois, VIII, pp. 398, 621.
1895. Ptilopora. Whidborne, Devon. Fauna England, (Pal. Soc part 4, p. 184.
1896. Ptilopora. Ulrich, Zittel's Textb. Pal. (Engl. ed.) p. 283.
1897. Ptilopora. Simpson, Fourteenth Ann. Rep. State Geologist the year 1894, pp. 519, 521.
1876–77. Dendricopora. De Koninck, Rech. sur les Foss. Pal. Galles du Sud, III, p. 169; 1898, Engl. translation, Me New South Wales, Pal. No. 6, p. 129.
1885. Dendricopora. Waagen and Pichl, Pal. Indica, Ser. XIII,

Ptilopora acuta Ulrich.

1890. Ptilopora acuta. Ulrich, Geol. Sur. Illinois, VIII, p. 622,
1894. Ptilopora acuta. Keyes, Missouri Geol. Sur., V, p. 31.
Keokuk: Keokuk and Bentonsport, Iowa.
Burlington: Burlington, Iowa.

Ptilopora cylindracea Ulrich.

1890. Ptilopora cylindracea. Ulrich, Geol. Sur. Illinois, VIII, p. 2–2*b*.
1894. Ptilopora cylindracea. Keyes, Missouri Geol. Sur., V, p. 32.
Keokuk: Kings Mountain, Kentucky; Bentonsport, Iowa.

Ptilopora infrequens Hall and Simpson.

1887. Ptilopora infrequens. Hall and Simpson, Pal. New York, lxvi, 26–29.
1897. Ptilopora infrequens. Simpson, Fourteenth Ann. Rep. St New York for the year 1894, pl. viii, 4, 6, 7.
Hamilton: Western New York.

Ptilopora nodosa Hall.

1883. Ptilopora nodosa. Hall, Trans. Albany Institute, X, p. 1881, p. 196).
1884. Ptilopora nodosa. Hall, Rep. State Geologist New York 1883, p. 59.

tilopora nodosa Hall—Continued.

1887. Ptilopora nodosa. Hall and Simpson, Pal. New York, VI, p. 285, pl. lxvi, 25.
1891. Ptilopora nodosa. Hall, Tenth Ann. Rep. State Geologist New York for the year 1890, p. 57; Forty-fourth Ann. Rep. New York State Museum, p. 87.
1897. Ptilopora nodosa. Simpson, Fourteenth Ann. Rep. State Geologist New York for the year 1894, pl. viii, 5.
Hamilton: Near Alden, New York.

tilopora paupera Ulrich.

1888. Ptilopora paupera. Ulrich, Bull. Denison Univ., IV, p. 74.
1890. Ptilopora paupera. Ulrich, Geol. Sur. Illinois, VII, p. 624, pl. lxvi, 10.
Waverly: Lodi, Ohio.
Keokuk: Kings Mountain, Kentucky.

tilopora prouti Hall.

1858. Ptilopora prouti. Hall, Pal. Iowa, p. 653, pl. xxii, 6*a*–*c*, 7.
1890. Ptilopora prouti. Ulrich, Geol. Sur. Illinois, VIII, p. 625, pl. lxv, 3–3*c*.
1894. Ptilopora prouti. Keyes, Missouri Geol. Sur., V, p. 32.
Warsaw: Barretts Station, Missouri; Warsaw, near New Providence, and Monroe County, Illinois.

tilopora striata Hall.

1883. Ptilopora striata. Hall, Trans. Albany Institute, X, p. 196 (abstract, 1881, p. 196).
1884. Ptilopora striata. Hall, Rep. State Geologist New York for the year 1883, p. 58.
1887. Ptilopora striata. Hall and Simpson, Pal. New York, VI, p. 283, pl. lxvi, 30–33.
1891. Ptilopora striata. Hall, Tenth Ann. Rep. State Geologist New York for the year 1890, p. 56; Forty-fourth Ann. Rep. New York State Museum, p. 86.
1897. Ptilopora striata. Simpson, Fourteenth Ann. Rep. State Geologist New York for the year 1894, pl. viii, 2, 3.
1898. Ptilopora striata. Whiteaves, Contr. Canadian Pal., I, p. 379.
Hamilton: Moscow and other localities in central and western New York; West Williams, Ontario.

tilopora valida Ulrich.

1890. Ptilopora valida. Ulrich, Geol. Sur. Illinois, VIII, p. 623, pl. lxv, 5–5*b*, pl. lxvi, 1–1*b*.
1894. Ptilopora valida, Keyes, Missouri Geol. Sur., V, p. 32.
Keokuk: Bentonsport and Keokuk, Iowa; Jersey County, Illinois.

TILOPORELLA Hall. Genotype: Fenestella (Ptiloporella) laticrescens Hall.

1885. Ptyloporella. Hall, Rep. State Geologist New York for the year 1884, p. 36.
1887. Ptiloporella. Hall and Simpson, Pal. New York, VI, p. xxiv.
1889. Ptiloporella. Miller, North American Geol. Pal., p. 319.
1895. Ptiloporella. Simpson, Thirteenth Ann. Rep. State Geologist New York for the year 1893, pp. 690, 704, 725; Forty-seventh Ann. Rep. New York State Museum, pp. 884, 898, 919. (On p. 704 (p. 898 of Museum Report) Simpson has inadvertently interchanged the terms Ptiloporella and Ptiloporina.)

PTILOPORELLA Hall—Continued.

1897. Ptiloporella. Simpson, Fourteenth Ann. Rep. State Geologist New York for the year 1894, pp. 506, 521.

1895. Pinnaporina. Simpson, Thirteenth Ann. Rep. State Geologist New York for the year 1893, p. 705 (not p. 725 = Ptiloporina); Forty-seventh Ann. Rep. New York State Museum, p. 899 (not p. 919).

1897. Pinnaporella. Simpson, Fourteenth Ann. Rep. State Geologist New York for the year 1894, pp. 507, 521.

Ptiloporella ? bifurca (Ulrich).

1886. Fenestella bifurca. Ulrich, Contr. American Pal., I, p. 6, pl. i, 2, 2*a*.

1887. Fenestella confertipora. Hall and Simpson, Pal. New York, VI, p. 108, pl. xlvi, 7–11, 17–21.

Hamilton: Falls of the Ohio.

Ptiloporella inæqualis (Hall and Simpson).

1887. Fenestella (Ptiloporella) inæqualis. Hall and Simpson, Pal. New York, VI, p. 171.

1897. Ptiloporella inæqualis. Simpson, Fourteenth Ann. Rep. State Geologist New York for the year 1894, pl. iv, 1, 2.

Upper Helderberg: Walpole, Ontario.

Ptiloporella laticrescens (Hall and Simpson).

1887. Fenestella (Ptiloporella) laticrescens. Hall and Simpson, Pal. New York, VI, p. 171.

1897. Ptiloporella laticrescens. Simpson, Fourteenth Ann. Rep. State Geologist New York for the year 1894, pl. iv, 3–6.

Upper Helderberg: Walpole, Ontario.

Ptiloporella nervata (Nicholson).

1875. Fenestella nervata. Nicholson, Pal. Ohio, II, p. 264, pl. xxv, 11, 11*a*.

1889. Ptiloporella nervata. Miller, North American Geol. Pal., p. 319.

Niagara: Cedarville, Ohio.

PTILOPORINA Hall. Genotype: Fenestella (Ptyloporina) conica Hall.

1885. Ptyloporina. Hall, Rep. State Geologist New York for the year 1884, p. 36.

1887. Ptiloporina. Hall and Simpson, Pal. New York, VI, p. xxiv.

1889. Ptiloporina. Miller, North American Geol. Pal., p. 319.

1895. Ptiloporina. Simpson, Thirteenth Ann. Rep. State Geologist New York for the year 1893, pp. 690, 725; Forty-seventh Ann. Rep. New York State Museum, pp. 884, 919.

1897. Ptiloporina. Simpson, Fourteenth Ann. Rep. State Geologist New York for the year 1894, pp. 507, 521. (Makes genotype Ptiloporina sinistralis.)

1895. Pinnaporella. Simpson, Thirteenth Ann. Rep. State Geologist New York for the year 1893, pp. 704, 725.

1895. Pinnaporina. Simpson, Thirteenth Ann. Rep. State Geologist New York for the year 1893, p. 725 (not p. 705 = Ptiloporella); Forty-seventh Ann. Rep. New York State Museum, p. 919, (not p. 899).

1897. Pinnaporina. Simpson, Fourteenth Ann. Rep. State Geologist New York for the year 1894, p. 507.

Ptiloporina conica (Hall and Simpson).

1887. Fenestella (Ptiloporina) conica. Hall and Simpson, Pal. New York, VI, p. 172, pl. xliii, 2–4.

1897. Ptiloporina conica. Simpson, Fourteenth Ann. Rep. State Geologist New York for the year 1894, pl. iv, 8.

Upper Helderberg: Schoharie, New York.

tiloporina disparilis (Hall and Simpson).

1887. Fenestella (Ptiloporina) disparilis. Hall and Simpson, Pal. New York, VI, p. 173, pl. xliii, 7, 8.

1897. Ptiloporina disparilis. Simpson, Fourteenth Ann. Rep. State Geologist New York for the year 1894, pl. iv, 11, 12.

Upper Helderberg: Walpole, Ontario.

tiloporina pinnata (Hall and Simpson).

1887. Fenestella (Ptiloporina) pinnata. Hall and Simpson, Pal. New York, VI, p. 172, pl. xliii, 5, 6.

1897. Pinnaporina pinnata. Simpson, Fourteenth Ann. Rep. State Geologist New York for the year 1894, pl. iv, 7.

1897. Ptiloporina pinnata. Simpson, Fourteenth Ann. Rep. State Geologist New York for the year 1894, pl. viii, 1.

Upper Helderberg: Schoharie, New York.

tiloporina sinistralis (Hall and Simpson).

1887. Fenestella (Ptiloporina) sinistralis. Hall and Simpson, Pal. New York, VI, p. 174, pl. xliii, 9.

1897. Ptiloporina sinistralis. Simpson, Fourteenth Ann. Rep. State Geologist New York for the year 1894, pl. iv, 9, 10.

Upper Helderberg: Schoharie, New York.

TILOTRYPA Ulrich. Genotype: Ptilotrypa obliquata Ulrich.

1890. Ptilotrypa. Ulrich, Geol. Sur. Illinois, VIII, p. 393.

1889. Ptilotrypa. (Ulrich, in press), Miller, North American Geol. Pal., p. 320.

1897. Ptilotrypa. Simpson, Fourteenth Ann. Rep. State Geologist New York for the year 1894, p. 542.

tilotrypa obliquata Ulrich.

1890. Ptilotrypa obliquata. Ulrich, Geol. Sur. Illinois, VIII, p. 531, pl. xxx, 1–1*e*.

1897. Ptilotrypa obliquata. Simpson, Fourteenth Ann. Rep. State Geologist New York for the year 1894, figs. 100–103 (p. 542).

Cincinnati (Richmond): Wilmington, Illinois.

tychonema Hall. See Monotrypa Nicholson.

tychonema Helderbergiæ Hall. See Monotrypa ? helderbergiæ (Hall).

tychonema tabulatum Miller. See Monotrypa tabulata (Hall).

AMIPORA Toula. Genotype: Ramipora hochstetteri Toula (from the Carboniferous of Spitzbergen).

1875. Ramipora. Toula, Neues Jahrbuch für Mineral., p. 230.

1878. Ramipora. Etheridge, Jun., Quar. Jour. Geol. Soc. London, XXXIV, p. 625.

1885. Ramipora. Waagen and Pichl, Pal. Indica, Ser. XIII, p. 775.

1889. Ramipora. Miller, North American Geol. Pal., p. 320.

1895. Ramipora. Whidborne, Devon. Fauna England, (Pal. Soc. Publ.), II, part 4, p. 186.

Obs. No species from the continent of North America has yet been described properly referable to this genus.

EPTARIA Rolle. Genotype: Reptaria stolonifera Rolle.

1851. Reptaria. Rolle, Leonhard und Bronn's Neues Jahrbuch, p. 810.

1887. Reptaria. Hall and Simpson, Pal. New York, VI, p. xxv.

1889. Reptaria. Miller, North American Geol. Pal., p. 320.

REPTARIA Rolle—Continued.

1897. Reptaria. Simpson, Fourteenth Ann. Rep. State Geologist New York for the year 1894, p. 599.

1899. Reptaria. Grabau, Bull. Buffalo Soc. Nat. Sci., VI, p. 178.

1883. Ptilionella. Hall, Trans. Albany Institute, X, p. 599 (abstract, 1881, p. 195).

Reptaria nodata (Hall).

1883. Ptilionella nodata. Hall, Trans. Albany Institute, X, p. 195 (abstract, 1881, p. 195).

1884. Ptilionella nodata. Hall, Rep. State Geologist New York for the year 1883, p. 57.

1887. Reptaria nodata. Hall and Simpson, Pal. New York, VI, p. 276.

Hamilton: Hopeton, Yates County, and Genesee Valley, Livingston County, New York.

Reptaria stolonifera Rolle.

1851. Reptaria stolonifera. Rolle, Leonhard und Bronn's Neues Jahrbuch, p. 810, pl. ix, 5, 6.

1887. Reptaria stolonifera. Hall and Simpson, Pal. New York, VI, p. 274, pl. lxv, 17-19.

1897. Reptaria stolonifera. Simpson, Fourteenth Ann. Rep. State Geologist New York for the year 1894, pl. xxv, 8, 9.

1899. Reptaria stolonifera. Grabau, Bull. Buffalo Soc. Nat. Sci., VI, p. 178, fig. 76.

1883. Ptilionella penniformis. Hall, Trans. Albany Institute, X, p. 195 (abstract, 1881, p. 195).

1884. Ptilionella penniformis. Hall, Rep. State Geologist New York for the year 1883, p. 56.

Hamilton: Cazenovia and Eighteenmile Creek, New York.

Retepora Lamarck. Not Paleozoic.

1874. Retepora (not Lamarck). Nicholson, Pal. Province Ontario, p. 101.

1885. Retepora (not Lamarck). Hall, Rep. State Geologist New York for the year 1884, p. 35.

Obs. The Retepora of most American authors is the genus Phylloporina.

Retepora angulata Hall. See Phylloporina angulata (Hall).

Retepora archimedes Owen. See Archimedes wortheni Hall.

Retepora asperato-striata Hall. See Phylloporina asperato-striata (Hall).

Retepora clintonii Vanuxem. Not defined.

1842. Retepora clintonii. Vanuxem, Geol. Rep. Third District New York, p. 87.

Clinton: No locality given.

Retepora diffusa Hall. See Drymotrypa diffusa (Hall).

Retepora fenestrata Hall. See Phylloporina fenestrata (Hall).

Retepora foliacea Hall. Abandoned by the author; fragment of some fossil not a bryozoan.

1847. Retepora foliacea. Hall, Pal. New York, I, p. 78, pl. xxvi, 9*a*, *b*.

Trenton: Lowville, Lewis County, New York.

Retepora flexuosa D'Orbigny. Not recognizable without material.

1842. Retepora flexuosa. D'Orbigny, Voyage dans l'Amérique Méridionale, III, p. 57, pl. vi, 6-8.

Carboniferous: Yarbichambi, Bolivia.

etepora gracilis Hall. See Phylloporina gracilis (Hall).

etepora hamiltonensis Prout. See Reteporina hamiltonensis (Prout).

etepora incepta Hall. See Phylloporina incepta (Hall).

etepora Phillipsi Nicholson. See Reteporina phillipsi (Nicholson).

etepora prisca (Goldfuss?) Nicholson. See Reteporina prisca (Goldfuss?) (Nicholson).

etepora Trentonensis Nicholson. See Phylloporina trentonensis (Nicholson).

eteporella Simpson. See Reteporidra.

eteporella adnata Simpson. See Reteporidra adnata (Hall).

eteporella undulata Simpson. See Reteporidra perundata (Hall).

ETEPORIDRA.[1] Genotype: Reteporella undulata Simpson = Fenestella perundata Hall.

1895. Reteporella. Simpson, Thirteenth Ann. Rep. State Geologist New York for the year 1893, pp. 702, 725; Forty-seventh Ann. Rep. New York State Museum, pp. 896, 919.

1897. Reteporella. Simpson, Fourteenth Ann. Rep. State Geologist New York for the year 1894, pp. 503, 521.

1897. Anastomopora. Simpson, Fourteenth Ann. Rep. State Geologist New York for the year 1894, pp. 517, 522.

Obs. Anastomopora was made for species resembling Reteporella, but differing in having thickened margins. This is a variable character in this group of species and is of no importance, either specifically or generically. Some specimens of Reteporidra show thickened margins.

eteporidra adnata (Hall).

1883. Fenestella adnata. Hall, Trans. Albany Institute, X, p. 167 (abstract, 1881, p. 25).

1886. Fenestella (Polypora) adnata. Hall, Fifth Ann. Rep. State Geologist New York for the year 1885, pl. xli, 1–8, 10.

1887. Fenestella (Polypora) adnata. Hall and Simpson, Pal. New York, VI, p. 152, pl. xli, 1–8, 10.

1897. Reteporella adnata. Simpson, Fourteenth Ann. Rep. State Geologist New York for the year 1894, pl. i, 4, 5.

Hamilton; Falls of the Ohio.

eteporidra cinctuta (Hall).

1884. Fenestella cinctuta. Hall, Thirty-sixth Ann. Rep. New York State Museum, p. 62.

1885. Lyropora cinctura. Hall, Rep. State Geologist New York for the year 1884, pl. i, 2.

1887. Fenestella (Lyropora) cinctuta. Hall, Sixth Ann. Rep. State Geologist New York for the year 1886, p. 69.

1888. Fenestella (Lyropora) cinctuta. Hall, Seventh Ann. Rep. State Geologist New York for the year 1887, pl. ix, 16; Forty-first Ann. Rep. New York State Museum, pl. ix, 16.

1897. Anastomopora cinctuta. Simpson, Fourteenth Ann. Rep. State Geologist New York for the year 1894, pl. ix, 20–23.

1890. Phyllopora ? sp. undet. Ulrich, Geol. Sur. Illinois, VIII, pl. lv, 10.

Hamilton: Geneseo, New York; West Williams and Widder, Ontario.

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[1] Proposed for Reteporella, preoccupied by Busk. See Challenger Report X, 1884, p. 126.

Reteporidra porundata (Hall).

1883. Fenestella perundata. Hall, Trans. Albany Institute, X, p. 1 1881, p. 27).

1883. Fenestella (Polypora) perundata. Hall, Rep. State Geologis for the year 1882, pl. xxxi, 7–13.

1885. Polypora perundata. Hall, Rep. State Geologist New York 1884, pl. i, 3.

1887. Fenestella (Polypora) perundata. Hall and Simpson, Pal. Ne p. 163, pl. xxxviii, 7–13.

1890. Phyllopora superba. Ulrich, Geol. Sur. Illinois, VIII, p. 613, pl. lv, 9, 9*a*.

1897. Reteporella undulata. Simpson, Fourteenth Ann. Rep. St New York for the year 1894, pl. i, 1–3.

Hamilton: Erie County, New York.

Obs. Hall and Simpson give this as occurring in the Uppe at Walpole, Ontario, but this is very probably an error.

RETEPORINA D'Orbigny. Genotype: Retepora prisca Go

1850. Reteporina. D'Orbigny, Prodr. de Pal., I, p. 101.

1885. Reteporina. Hall, Rep. State Geologist New York for the ye

1889. Reteporina. Miller, North American Geol. Pal., p. 320.

1894. Reteporina. Počta, Syst. Sil. Bohême, VIII, t. 1, p. 80.

1895. Reteporina. Simpson, Thirteenth Ann. Rep. State Geologist the year 1893, p. 725; Forty-seventh Ann. Rep. New Yor p. 919.

1897. Reteporina. Simpson, Fourteenth Ann. Rep. State Geologis for the year 1894, pp. 504, 521.

1899. Reteporina. Grabau, Bull. Buffalo Soc. Nat. Sci., VI, p. 161.

Reteporina coalescens (Hall and Simpson).

1887. Fenestella (Reteporina) coalescens. Hall and Simpson, Pal. VI, p. 120.

Upper Helderberg: Walpole, Ontario.

Reteporina flexuosa (Ulrich).

1890. Fenestella flexuosa. Ulrich, Geol. Sur. Illinois, VIII, p. 548,

1894. Fenestella flexuosa. Keyes, Missouri Geol. Surv., V, p. 24.

Chester: Sloans Valley, Kentucky.

Reteporina hamiltonensis (Prout).

1866. Retepora hamiltonensis. Prout, Trans. St. Louis Acad. Sci., I

1866. Polypora Hamiltonensis. Prout, Geol. Surv. Illinois, II, p. 6, 6*a*.

1876–7. Protoretepora (Polypora) hamiltoniana. De Koninck, Rech Paleoz. de la Nouv. Galles des Sud, III, p. 179; 1898, Engl. Geol. Surv. New South Wales, Pal., No. 6, p. 137.

1889. Reteporina hamiltonensis. Miller, North American Geol. Pa

Hamilton: Buffalo, Iowa; Rock Island, Illinois.

Reteporina pertollata Hall (not defined).

1885. Reteporina pertollata. Hall, Rep. State Geologist New Yor 1884, pl. i, 1.

Reteporina perundulata (Hall).

1884. Fenestella perundulata. Hall, Thirty-sixth Ann. Rep. New Mus., p. 63.

1887. Fenestella perundulata. Hall, Sixth Ann. Rep. State G York for the year 1886, p. 43, pl. ii, 1–14.

1889. Reteporina perundulata. Miller, North American Geol. Pal.

eteporina perundulata (Hall)—Continued.
1897. Reteporina perundulata. Simpson, Fourteenth Ann. Rep. State Geologist New York for the year 1894, pl. i, 8.
Hamilton: Moscow, New York.

eteporina phillipsi (Nicholson).
1874. Retepora Phillipsi. Nicholson, Geol. Mag., new ser., I, p. 163, pl. ix, 21.
1874. Retepora Phillipsi. Nicholson, Pal. Province Ontario, p. 102, fig. 39.
1889. Reteporina phillipsi. Miller, North American Geol. Pal., p. 320.
Upper Helderberg: Port Colborne, Ontario.

eteporina prisca (Goldfuss ?) (Nicholson).
1826. Retepora prisca. Goldfuss, Petref. Germaniæ, p. 103, pl. xxxvi, 19.
1874. Retepora prisca Goldfuss. Nicholson, Pal. Province Ontario, p. 101, fig. 38.
1889. Reteporina prisca. Miller, North American Geol. Pal., p. 320.
1898. Retepora prisca (Goldfuss) Nicholson. Whiteaves, Contr. Canadian Pal., I, part V, p. 379.
Upper Helderberg: Ridgeway and Port Colborne, Ontario.
Hamilton: Arkona, Ontario.
Obs. It is scarcely probable that Nicholson's specimens are cospecific with Goldfuss's.

eteporina rhombifera (Hall).
1883. Fenestella rhombifera. Hall, Trans. Albany Institute, X, p. 174 (abstract, 1881, p. 32).
1886. Fenestella rhombifera. Hall, Fifth Ann. Rep. State Geologist New York for the year 1885, pl. l, 18, 19.
1887. Fenestella (Reteporina) rhombifera. Hall and Simpson, Pal. New York, VI, p. 120, pl. l, 18, 19.
Upper Helderberg: Ontario, Canada. (In the Trans. Albany Institute, X, p. 174, the locality is given as Le Roy, New York.)

eteporina striata (Hall).
1884. Fenestella strata. Hall, Thirty-sixth Ann. Rep. New York State Mus., p. 72.
1887. Fenestella (Reteporina) striata. Hall, Sixth Ann. Rep. State Geologist New York for the year 1886, p. 45, pl. iii, 1–6.
1897. Reteporina striata. Simpson, Fourteenth Ann. Rep. State Geologist New York for the year 1894, pl. i, 6, 7.
1899. Reteporina striata. Grabau, Bull. Buffalo Soc. Nat. Sci., VI, p. 161, fig. 50.
Hamilton: Moscow, New York.

HABDOMESON Young and Young. Genotype: Millepora gracilis Phillips.
1874. Rhabdomeson. Young and Young, Ann. Mag. Nat. Hist., ser 4, XIII, p. 337.
1875. Rhabdomeson. Young and Young, Ann. Mag. Nat. Hist., ser. 4, XV, p. 334.
1885. Rhabdomeson. Vine, Proc. Yorkshire Geol. Polyt. Soc., IX, p. 91.
1890. Rhabdomeson. Ulrich, Geol. Surv. Illinois, VIII, p. 402.
Obs. No American species has yet been referred to this genus.

HINIDICTYA Ulrich. Genotype: Rhinidictya nicholsoni Ulrich.
1847. Stictopora (in part). Hall, Pal. New York, I, p. 73.
1882. Rhinidictya. Ulrich, Jour. Cincinnati Soc. Nat. Hist., V, p. 152.
1887. Rhinidictya. Hall and Simpson, Pal. New York, VI, p. xx.
1889. Rhinidictya. Miller, North American Geol. Pal., p. 320.
1893. Rhinidictya. Ulrich, Geol. Minnesota, III, p. 124.

RHINIDICTYA Ulrich—Continued.

1896. Rhinidictya. Ulrich, Zittel's Textb. Pal. (Engl. ed.), p. 279.
1897. Rhinidictya. Simpson, Fourteenth Ann. Rep. State Geologis for the year 1894, p. 605.
1890. Stictopora (not of Hall). Ulrich, Geol. Sur. Illinois, VIII, p. 3

Rhinidictya basalis (Ulrich).

1882. Stictopora basalis. Ulrich, Jour. Cincinnati Soc. Nat. His pl. viii, 4, 4*a*.
1893. Rhinidictya basalis. Ulrich, Geol. Minnesota, III, p. 128.
Trenton (Stones River): Shelbyville, Tennessee.

Rhinidictya exigua Ulrich.

1890. Rhinidictya exigua. Ulrich, Jour. Cincinnati Soc. Nat. Hist., fig. 9.
1893. Rhinidictya exigua. Ulrich, Geol. Minnesota, III, p. 131, pl.
Trenton (Stones River and Black River): Minneapolis, St. Pau tain, Minnesota.

Rhinidictya fenestrata (Hall).

1847. Stictopora fenestrata. Hall, Pal. New York, I, p. 16, pl. iv, 4*a*–
1850. Sulcopora fenestrata. D'Orbigny, Prodr. de Pal., I, 22.
1890. Rhinidictya fenestrata. Ulrich, Geol. Sur. Illinois, VIII, p. 49
Chazy: Chazy and Galway, New York.

Rhinidictya fidelis (Ulrich).

1886. Stictopora fidelis (in part). Ulrich, Fourteenth Ann. Rep. Ge Surv. Minnesota, p. 68.
1893. Rhinidictya fidelis. Ulrich, Geol. Minnesota, III, p. 134, pl. vi
1893. Eurydictya multipora (in part). Ulrich, Geol. Minnesota, pl. vii, 24, 29–31.
Trenton (Stones River): Minneapolis, Minnesota.

Rhinidictya grandis Ulrich.

1893. Rhinidictya grandis. Ulrich, Geol. Minnesota, III, p. 136, pl. vi, 19, 20.
Trenton (Stones River): Dixon, Illinois; Beloit, Mineral Poin ville, Wisconsin.

Rhinidictya ? granulosa Hall and Simpson. See Dicranop losa (Hall).

Rhinidictya granulosa Simpson. See Dicranopora granulos

Rhinidictya humilis Ulrich. See Pachydictya pumila Ulric

Rhinidictya lata (Ulrich).

1882. Dicranopora lata. Ulrich, Jour. Cincinnati Soc. Nat. Hist., V, 16, 16*a*.
Cincinnati (Richmond): Oxford and Clarksville, Ohio.

Rhinidictya minima Ulrich.

1890. Rhinidictya minima. Ulrich, Jour. Cincinnati Soc. Nat. Hist. fig. 8.
1893. Rhinidictya minima. Ulrich, Geol. Minnesota, III, p. 132, pl.
Trenton: Cannon Falls, Minnesota.

Rhinidictya minima-modesta Ulrich.

1893. Rhinidictya minima var. modesta. Ulrich, Geol. Minnesota pl. v, 17.
Trenton: Cannon Falls, Minnesota.

Rhinidictya mutabilis (Ulrich).

1886. Stictopora mutabilis (in part). Ulrich, Fourteenth Ann. Rep. Geol. Nat. Hist. Sur. Minnesota, p. 66.
1889. Stictopora mutabilis. Miller, North American Geol. Pal., fig. 517 (p. 324).
1890. Stictopora mutabilis. Ulrich, Geol. Sur. Illinois, VIII, figs. 2*c*–*h* (p. 304).
1893. Rhinidictya mutabilis. Ulrich, Geol. Minnesota, III, p. 125, pl. vi, 1–6, 12, 13, pl. vii, 10–23, 25–28, pl. viii, 1–3.
1897. Rhinidictya mutabilis. Whiteaves, Pal. Foss, III, p. 240.
1886. Stictopora mutabilis var. minor. Ulrich, Fourteenth Ann. Rep. Geol. Nat. Hist. Sur. Minnesota, p. 67.
Trenton (Stones River, Black River, and Trenton): Minneapolis, St. Paul, Cannon Falls, and other localities in Minnesota; Decorah, Iowa.

Rhinidictya mutabilis-major (Ulrich).

1886. Stictopora mutabilis var. major. Ulrich, Fourteenth Ann. Rep. Geol. Nat. Hist. Sur. Minnesota, p. 66.
1893. Rhinidictya mutabilis var. major. Ulrich, Geol. Minnesota, III, p. 127, pl. vii, 22, 23, 25–28, 32.
Trenton (Black River): St. Paul, Minneapolis, and Cannon Falls, Minnesota.

Rhinidictya mutabilis-senilis Ulrich.

1893. Rhinidictya mutabilis var. senilis. Ulrich, Geol. Minnesota, III, p. 127, pl. vi, 2, 3, pl. vii, 16, 17.
Trenton (Black River): St. Paul, Minnesota.

Rhinidictya nashvillensis (Miller).

1880. Bythopora nashvillensis. Miller, Jour. Cincinnati Soc. Nat. Hist., III, p. 143, pl. iv, 4, 4*a*.
1889. Bythopora nashvillensis. Miller, North American Geol. Pal., fig. 462 (p. 295).
1890. Rhinidictya nashvillensis. Ulrich, Jour. Cincinnati Soc. Nat. Hist., XII, p. 185.
Trenton: Near Nashville, Tennessee (?).
Obs. The locality given above is probably incorrect. The species occurs in the Pierce limestone (Stones River) at Murfreesboro, Tennessee.

Rhinidictya neglecta Ulrich.

1886. Stictopora paupera (in part). Ulrich, Fourteenth Ann. Rep. Geol. Nat. Hist. Sur. Minnesota, p. 69.
1893. Rhinidictya neglecta. Ulrich, Geol. Minnesota, III, p. 130, pl. v., 22–25.
Trenton: Frankfort, Boyle, and Mercer counties, Kentucky; Nashville, Tennessee; St. Paul, Minnesota.

Rhinidictya neglecta-canadensis Ulrich.

1893. Rhinidictya neglecta var. canadensis. Ulrich, Geol. Minnesota, III, p. 130.
Trenton: Ottawa, Canada.

Rhinidictya nicholsoni Ulrich.

1882. Rhinidictya nicholsoni. Ulrich, Jour. Cincinnati Soc. Nat. Hist., V, p. 170, pl. viii, 6–6*b*.
1889. Rhinidictya nicholsoni. Miller, North American Geol. Pal., fig. 507 (p. 320).
Trenton (Stones River): High Bridge, Kentucky.

Rhinidictya obliqua (Ulrich) Whiteaves.

1897. Rhinidictya obliqua Ulrich. Whiteaves, Pal. Foss., III, p. 240.

Trenton: Deer Island, Lake Winnipeg, Canada.

Obs. Though unquestionably distinct, this species requires further work before it can be regarded as valid.

Rhinidictya parallela (James).

1878. Ptilodictya parallela. James, Paleontologist, No. 1, p. 5.

1882. Rhinidictya parallela. Ulrich, Jour. Cincinnati Soc. Nat. Hist., V, p. 170.

1878. Ptilodictya granulosa. James, Paleontologist, No. 1, p. 4.

Cincinnati (Utica): Cincinnati, Ohio, and vicinity.

Obs. Although the description of P. granulosa precedes that of P. parallela, the latter name much better defines the usual appearance of the species, and therefore deserves to be the one retained.

Rhinidictya paupera Ulrich.

1886. Stictopora paupera (in part). Fourteenth Ann. Rep. Geol. Nat. Hist. Surv. Minnesota, p. 69.

1893. Rhinidictya paupera. Ulrich, Geol. Minnesota, III, p. 129, pl. v, 19–21.

Trenton (Black River): St. Paul and Cannon Falls, Minnesota; Decorah, Iowa.

Rhinidictya pediculata Ulrich.

1893. Rhinidictya pediculata. Ulrich, Geol. Minnesota, III, p. 137, pl. vii, 1–5.

Trenton (Stones River): Minneapolis, Minnesota.

Rhinidictya trentonensis (Ulrich).

1882. Dicranopora trentonensis. Ulrich, Jour. Cincinnati Soc. Nat. Hist., V, p. 167, pl. vi, 15, 15*a*.

1893. Rhinidictya trentonensis. Ulrich, Geol. Minnesota, III, p. 135, pl. vi, 14–18, pl. vii, 6–9.

1886. Stictopora fidelis (in part). Ulrich, Fourteenth Ann. Rep. Geol. Nat. Hist. Sur. Minnesota, p. 68.

Trenton (Stones River): Lebanon, Tennessee; Minneapolis, Minnesota; Janesville, Wisconsin; Rockton, Illinois.

RHINOPORA Hall. Genotype: Rhinopora verrucosa Hall.

1852. Rhinopora. Hall, Pal. New York, II, p. 48.

1887. Rhinopora. Foerste, Bull. Sci. Lab. Denison Univ., II, p. 166.

1889. Rhinopora. Miller, North American Geol. Pal., p. 321.

1890. Rhinopora. Ulrich, Geol. Surv. Illinois, VIII, p. 388.

1896. Rhinopora. Ulrich, Zittel's Textb. Pal. (Engl. ed.), p. 280.

1897. Rhinopora. Simpson, Fourteenth Ann. Rep. State Geologist New York for the year 1894, p. 540.

Rhinopora curvata Ringueberg. See Rhinopora verrucosa Hall.

Rhinopora frondosa Hall and Whitfield. See Rhinopora verrucosa Hall.

Rhinopora prima Whitfield.

1897. Rhinopora prima. Whitfield, Bull. American Mus. Nat. Hist., IX, p. 177, pl. iv, 5, 6.

Calciferous: Fort Cassin, Vermont.

Obs. This is probably not a bryozoan.

Rhinopora ? tuberculosa Hall.

1852. Rhinopora tuberculosa. Hall, Pal. New York, II, p. 170, pl. xlE, 4*a–c*.

Niagara: Lockport, New York.

Rhinopora ? tubulosa Hall.

1852. Rhinopora tubulosa. Hall, Pal. New York, II, p. 49, pl. xix, 2*a*–*c*.
Clinton: Sodus, Wayne County, and Reynales Basin, New York.

Rhinopora venosa Spencer. See Rhinopora verrucosa Hall.

Rhinopora verrucosa Hall.

1852. Rhinopora verrucosa. Hall, Pal. New York, II, p. 48, pl. xix, 1*a*–*c*.
1874. Rhinopora verrucosa. Nicholson and Hinde, Canadian Jour., new ser., XIV, p. 141.
1875. Rhinopora verrucosa. Nicholson, Pal. Province Ontario, p. 44, fig. 19, 1, 1*a*.
1887. Rhinopora verrucosa. Foerste, Bull. Sci. Lab. Denison Univ., II, p. 166; ibid., III, 1888, pl. xv, 13.
1889. Rhinopora verrucosa. Foerste, Proc. Boston Soc. Nat. Hist., xxiv, p. 332.
1895. Rhinopora verrucosa. Foerste, Geol. Surv. Ohio, VII, p. 599, pl. xxviii, 13*a*–*c*.
1875. Escharina ? distorta. James, Paleontologist, No. 3, p. 21.
*1884. Rhinopora venosa. Spencer, Trans. St. Louis Acad. Sci., IV, p. 604, pl. vii, 3.
*1884. Rhinopora venosa. Spencer, Bull. Mus. Univ. State Missouri, I, p. 54, pl. vii, 3.
*1886. Rhinopora curvata. Ringueberg, Bull. Buffalo Soc. Nat. Hist., V, p. 19, pl. ii, 14.

Clinton: Flamboro Head and Dundas, Canada; Cumberland Gap, Tennessee; Collinsville, Alabama; Hanover, Indiana (Foerste); Dayton, Fair Haven, Todds Fork, and Yellow Springs, Ohio.

Obs. The citations preceded by the (*) refer to very poor descriptions of poorly preserved fossils, but there is scarcely any doubt but that the names are synonyms.

HOMBOPORA Meek. Genotype: Rhombopora lepidodendroides Meek.

1872. Rhombopora. Meek, Pal. Eastern Nebraska, p. 141.
1877. Rhombopora. Etheridge, Jun., Ann. Mag. Nat. Hist., ser. 4, XX, p. 36.
1883. Rhombopora. Vine, Proc. Yorkshire Geol. Polyt. Soc., VIII, p. 105.
1884. Rhombopora. Ulrich, Jour. Cincinnati Soc. Nat. Hist., VII, p. 26.
1885. Rhombopora. Vine, Proc. Yorkshire Geol. Polyt. Soc., IX, p. 93.
1887. Rhombopora. Foerste, Bull. Sci. Lab. Denison Univ., II, p. 71.
1889. Rhombopora. Miller, North American Geol. Pal., p. 321.
1890. Rhombopora. Ulrich, Geol. Surv. Illinois, VIII, pp. 402, 647.
1896. Rhombopora. Ulrich, Zittel's Textb. Pal. (Engl. ed.), p. 281.
1897. Rhombopora. Simpson, Fourteenth Ann. Rep. State Geologist New York for the year 1894, p. 550.
1899. Rhombopora. Grabau, Bull. Buffalo Soc. Nat. Sci., VI, p. 164.
Vincularia of some foreign authors.

hombopora angustata Ulrich.

1890. Rhombopora angustata. Ulrich, Geol. Surv. Illinois, VIII, p. 652, pl. lxx, 6, 6*a*.
Keokuk: Kings Mountain, Kentucky.

hombopora armata Ulrich.

1884. Rhombopora armata. Ulrich, Jour. Cincinnati Soc. Nat. Hist., VII, p. 31, pl. i, 5, 5*a*.
Chester: Sloans Valley, Kentucky.

hombopora ? asperrima (Ulrich, in press) Miller. See Rhombopora ? asperula Ulrich.

Rhombopora ? asperula Ulrich.

1890. Rhombopora ? asperula. Ulrich, Geol. Surv. Illinois, VIII, p. 656, pl. lxx, 9–9*e*.

1889. Rhombopora ? asperrima (in error for asperula). (Ulrich, in press), Miller, North American Geol. Pal., p. 321.

Keokuk: Keokuk, Iowa; Nauvoo and Warsaw, Illinois.

Rhombopora attenuata Ulrich.

1890. Rhombopora attenuata. Ulrich, Geol. Surv. Illinois, VIII, p. 655, pl. lxx, 7.

1894. Rhombopora attenuata. Keyes, Missouri Geol. Surv., V, p. 34.

Keokuk: Warsaw, Illinois.

Rhombopora confluens Ulrich. See Acanthoclema confluens (Ulrich).

Rhombopora crassa Ulrich.

1884. Rhombopora crassa. Ulrich, Jour. Cincinnati Soc. Nat. Hist., VII, p. 28, pl. i, 2–2*b*.

1894. Rhombopora crassa. Keyes, Missouri Geol. Surv., V, p. 34.

Coal Measures: Kansas City, Missouri.

Rhombopora decipiens Ulrich.

1890. Rhombopora decipiens. Ulrich, Geol. Surv. Illinois, VIII, p. 657, pl. lxxi, 3–3*d*.

St. Louis: Monroe County, Illinois.

Rhombopora dichotoma Ulrich.

1890. Rhombopora dichotoma. Ulrich, Geol. Surv. Illinois, VIII, p. 650, pl. lxx, 13–13*b*.

1894. Rhombopora dichotoma. Keyes, Missouri Geol. Surv., V, p. 33.

Burlington: Burlington, Iowa.

Keokuk: Warsaw, Illinois.

Rhombopora elegantula Ulrich.

1884. Rhombopora elegantula. Ulrich, Jour. Cincinnati Soc. Nat. Hist., VII, p. 33, pl. i, 3–3*b*.

1890. Anisotrypa elegantula. Ulrich, Geol. Surv. Illinois, VIII, p. 447.

Keokuk: Kings Mountain, Kentucky.

Rhombopora exigua Ulrich.

1890. Rhombopora exigua. Ulrich, Geol. Surv. Illinois, VIII, p. 651, pl. lxx, 10, 10*a*.

Burlington: Burlington, Iowa.

Rhombopora exilis (Dawson).

1868. Stenopora exilis. Dawson, Acadian Geology, p. 287.

1878. Stenopora exilis. Dawson, Acadian Geology, ed. 3, p. 287, fig. 85*a*.

1889. Stenopora exilis. Miller, North American Geol. Pal., fig. 218 (p. 203).

Carboniferous: Windsor and Stewiacke, Nova Scotia.

Rhombopora gracilis Ulrich.

1890. Rhombopora gracilis. Ulrich, Geol. Surv. Illinois, VIII, p. 651, pl. lxx, 11–11*b*.

Burlington: Burlington, Iowa.

Rhombopora granulifera Ulrich. See Batostomella granulifera (Hall).

Rhombopora Hamiltonensis Nicholson and Lyddeker. See Streblotrypa hamiltonensis (Nicholson).

Rhombopora hexagona Grabau. See Orthopora hexagona (Hall and Simpson).

Rhombopora immersa Grabau. See Orthopora immersa (Hall and Simpson).

Rhombopora incrassata Ulrich.

1888. Rhombopora incrassata. Ulrich, Bull. Denison Univ., IV, p. 89, pl. xiv, 16, ? 16*a*.

1890. Rhombopora incrassata. Ulrich, Geol. Surv. Illinois, VIII, p. 652, pl. lxx, 12–12*d*.

Waverly: Lodi, Ohio.

Keokuk: Kings Mountain and Button Mole Knob, near Louisville, Kentucky.

Rhombopora lepidodendroides Meek.

1866. Stenopora columnaris (not of Schlotheim, 1813) (in part). Geinitz, Carb. und Dyas in Nebraska, p. 66.

1872. Rhombopora lepidodendroides. Meek, Pal. Eastern Nebraska, p. 141, pl. vii, 2*a–f*.

1877. Rhombopora lepidodendroides (?). White, Wheeler's United States Geol. Surv., IV, Pal., p. 99, pl. vi, 5*a–d*.

1884. Rhombopora lepidodendroidea. Ulrich, Jour. Cincinnati Soc. Nat. Hist., VII, p. 27, pl. i, 1–1*b*.

1887. Rhombopora lepidodendroidea. Foerste, Bull. Sci. Lab. Denison Univ., II, p. 73, pl. vii, 3*a*, *b*.

1888. Rhombopora lepidodendroides. Keyes, Proc. Acad. Nat. Sci. Philadelphia, p. 225.

1894. Rhombopora lepidodendroides. Keyes, Missouri Geol. Surv., V, p. 35, pl. xxxiii, 4*a*, *b*.

1896. Rhombopora lepidodendroides. Smith, Proc. American Phil. Soc., XXXV, p. 237.

Coal Measures: Nebraska City and Wyoming, Nebraska. A rather common species at various localities in Nebraska, Kansas, Missouri, Iowa, Illinois, and Ohio.

Rhombopora lineata Grabau. See Orthopora lineata (Hall).

Rhombopora lineinodis Ulrich.

1890. Rhombopora lineinodis. Ulrich, Geol. Surv. Illinois, VIII, p. 649, pl. xlv, 3–3*b*.

Hamilton: Falls of the Ohio.

Rhombopora lineinodis-humilis Ulrich.

1890. Rhombopora lineinodis var. humilis. Ulrich, Geol. Surv. Illinois, VIII, p. 649, pl. xlv, 4, 4*a*.

Hamilton: Falls of the Ohio.

Rhombopora minor Ulrich.

1890. Rhombopora minor. Ulrich, Geol. Surv. Illinois, VIII, p. 659, pl. lxx, 4, 4*a*.

Chester: Sloans Valley and Litchfield, Kentucky.

Rhombopora multipora Foerste.

1887. Rhombopora multipora. Foerste, Bull. Sci. Lab. Denison Univ., II, p. 72, pl. vii, 1*a–c*.

Coal Measures: Flint Ridge, Ohio; Seville, Illinois.

Rhombopora nicklesi Ulrich.

1890. Rhombopora nicklesi. Ulrich, Geol. Surv. Illinois, VIII, p. 661, pl. lxx, 1–1*c*.

Lower Coal Measures: Sparta, Illinois.

Rhombopora ohioensis Ulrich.

1888. Rhombopora ohioensis. Ulrich, Bull. Denison Univ., IV, p. 90, pl. xiv, 15, 15*a*.

1895. Rhombopora ohioensis. Herrick, Geol. Surv. Ohio, VII, pl. xix, 9.

Waverly: Richfield, Lodi, and Moots Run, Ohio.

Rhombopora persimilis Ulrich.

1884. Rhombopora persimilis. Ulrich, Jour. Cincinnati Soc. Nat. Hist., VII, p. 30, pl. i, 7–7*d*.

1890. Rhombopora persimilis. Ulrich, Geol. Surv. Illinois, VIII, p. 659, pl. lxx, 3.

Chester: Chester, Illinois, and Sloans Valley, Kentucky.

Rhombopora polygona Grabau. See Orthopora polygona (Hall).

Rhombopora pulchella Ulrich.

1884. Rhombopora pulchella. Ulrich, Jour. Cincinnati Soc. Nat. Hist., VII, p. 31, pl. i, 6, 6*a*.

Chester: Sloans Valley, Kentucky.

Rhombopora regularis Simpson. See Orthopora regularis (Hall).

Rhombopora reticulata Grabau. See Orthopora reticulata (Hall and Simpson).

Rhombopora simulatrix Ulrich.

1890. Rhombopora simulatrix. Ulrich, Geol. Surv. Illinois, VIII, p. 657, pl. lxxi, 2–2*e*.

St. Louis: Columbia and other localities in Monroe County, Illinois.

Rhombopora ? spiralis Ulrich.

1890. Rhombopora ? spiralis. Ulrich, Geol. Surv. Illinois, VIII, p. 656, pl. lxxi, 5–5*d*.

Keokuk: Kings Mountain, Kentucky.

Rhombopora subannulata Ulrich.

1890. Rhombopora subannulata. Ulrich, Geol. Surv. Illinois, VIII, p. 648, pl. xlv, 1–1*i*.

Hamilton: Buffalo, Iowa.

Rhombopora sulcifera Ulrich.

1890. Rhombopora sulcifera. Ulrich, Geol. Surv. Illinois, VIII, p. 649, pl. xlv, 2–2*b*.

Hamilton: Davenport, Iowa.

Rhombopora tabulata Ulrich.

1890. Rhombopora tabulata. Ulrich, Geol. Surv. Illinois, VIII, p. 658, pl. lxx, 2–2*c*.

1894. Rhombopora tabulata. Keyes, Missouri Geol. Surv., V, p. 34.

Chester: Chester and Kaskaskia, Illinois; Sloans Valley, Kentucky.

Rhombopora tenuirama Ulrich.

1890. Rhombopora tenuirama. Ulrich, Geol. Surv. Illinois, VIII, p. 660, pl. lxx, 8–8*b*.

1894. Rhombopora tenuirama. Keyes, Missouri Geol. Surv., V, p. 34.

Chester: Kaskaskia, Illinois; Sloans Valley, Kentucky.

Rhombopora tortalinea Grabau. See Orthopora tortalinea (Hall).

Rhombopora transversa Grabau. See Orthopora transversa (Hall).

Rhombopora transversa Simpson. See Orthopora hexagona (Hall and Simpson).

hombopora transversalis Ulrich.

1890. Rhombopora transversalis. Ulrich, Geol. Surv. Illinois, VIII, p. 654, pl. lxxi, 4–4*b*.

1894. Rhombopora transversalis. Keyes, Missouri Geol. Surv., V, p. 34.

Keokuk: Plymouth, Nauvoo, and Warsaw, Illinois.

hombopora varia (Ulrich, in press) Miller. See Rhombopora varians Ulrich.

hombopora varians Ulrich.

1890. Rhombopora varians. Ulrich, Geol. Surv. Illinois, VIII, p. 653, pl. lxxi, 1–1*f*.

1889. Rhombopora varia (in error for varians). (Ulrich, in press), Miller North American Geol. Pal., p. 321.

1894. Rhombopora varians. Keyes, Misouri Geol. Surv., V, p. 33.

Keokuk: Near Plymouth, near Whitehall, Warsaw, and Nauvoo, Illinois.

hombopora wortheni Urich.

1884. Rhombopora wortheni. Ulrich, Jour. Cincinnati Soc. Nat. Hist., VII, p. 32, pl. i, 4–4*b*.

St. Louis: Somerset, Kentucky.

HOPALONARIA Ulrich. Genotype: Rhopalonaria venosa Ulrich.

1879. Ropalonaria. Ulrich, Jour. Cincinnati Soc. Nat. Hist., II, p. 26.

1882. Ropalonaria. Ulrich, Jour. Cincinnati Soc. Nat. Hist., V. p. 149.

1884. Ropalonaria. Vine, Ann. Mag. Nat. Hist., ser. 5, XIV, p. 84, fig. iv.

1889. Rhopalonaria. Miller, North American Geol. Pal., p. 321.

1890. Rhopalonaria. Ulrich, Geol. Surv. Illinois, VIII, p. 367.

1897. Rhopalonaria. Simpson, Fourteenth Ann. Rep. State Geologist New York for the year 1894, p. 603.

hopalonaria pertenuis Ulrich. See Stomatopora delicatula James.

hopalonaria venosa Ulrich.

1879. Ropalonaria venosa. Ulrich, Jour. Cincinnati Soc. Nat. Hist., II, p. 26, pl. vii, 24, 24*a*.

1889. Rhopalonaria venosa. Miller, North American Geol. Pal., fig. 511 (p. 321).

1893. Rhopalonaria venosa. Ulrich, Geol. Minnesota, III, p. 114, fig. 8*e*.

1897. Rhopalonaria venosa. Simpson, Fourteenth Ann. Rep. State Geologist New York for the year 1894, fig. 221 (p. 603).

Cincinnati (Lorraine and Richmond): Clarksville, Waynesville, Oregonia and Hanover, Ohio; Versailles, Indiana.

opalonaria. See Rhopalonaria.

osacilla F. A. Roemer. See Berenicea Lamouroux.

agenella Hall. See Berenicea Lamouroux.

agenella ambigua Walcott. Not recognizable.

1883. Sagenella ambigua. Walcott, Trans. Albany Institute, X. p. 22, pl. i, 3, 3*a*.

Utica Slate: Trenton, New York.

agenella elegans Hall. See Berenicea elegans (Hall).

agenella membranacea Hall. See Berenicea membranacea (Hall).

agenella striata James. See Escharopora falciformis (Nicholson).

SCALARIPORA Hall. Genotype: Scalaripora scalariformis Hall.

1883. Scalaripora. Hall, Trans. Albany Institute, X, p. 159 (abstract, 1881, p. 17).
1887. Scalaripora. Hall and Simpson, Pal. New York, VI, p. xxi.
1889. Scalaripora. Miller, North American Geol. Pal., p. 321.
1890. Scalaripora. Ulrich, Geol. Surv. Illinois, VIII, p. 387.
1897. Scalaripora. Simpson, Fourteenth Ann. Rep. State Geologist New York for the year 1894, p. 532.

Scalaripora approximata Ulrich.

1890. Scalaripora approximata. Ulrich, Geol. Surv. Illinois, VIII, p. 508, pl. xliii, 3.
Hamilton; Near Alpena, Michigan.

Scalaripora canadensis Whiteaves.

1898. Scalaripora Canadensis. Whiteaves, Contr. Canadian Pal., I, p. 378, pl. xlviii, 10–10*b*.
Hamilton: Thedford, Ontario.

Scalaripora scalariformis Hall.

1883. Scalaripora scalariformis. Hall, Trans. Albany Institute, X, p. 159 (abstract, 1881, p. 18).
1886. Scalaripora scalariformis. Hall, Fifth Ann. Rep. State Geologist New York for the year 1885, pl. xxix, 4–8.
1887. Scalaripora scalariformis. Hall and Simpson, Pal. New York, VI, p. 100, pl. xxix, 4–8.
1897. Scalaripora scalariformis. Simpson, Fourteenth Ann. Rep. State Geologist New York for the year 1894, pl. xii, 16–20.
Hamilton: Falls of the Ohio.

Scalaripora separata Ulrich.

1890. Scalaripora separata. Ulrich, Geol. Surv. Illinois, VIII, p. 507, pl. xliii, 2.
Hamilton: Thunder Bay, Michigan.

Scalaripora subconcava Hall.

1883. Scalaripora subconcava. Hall, Trans. Albany Institute, X, p. 160 (abstract, 1881, p. 18).
1886. Scalaripora subconcava. Hall, Fifth Ann. Rep. State Geologist New York for the year 1885, pl. xxix, 1–3.
1887. Scalaripora subconcava. Hall and Simpson, Pal. New York, VI, p. 100, pl. xxix, 1–3.
1897. Scalaripora subconcava. Simpson, Fourteenth Ann. Rep. State Geologist New York for the year 1894, pl. xii, 21, 22.
Hamilton: Falls of the Ohio.

SCENELLOPORA Ulrich. Genotype: Scenellopora radiata Ulrich.

1882. Scenellopora. Ulrich, Jour. Cincinnati Soc. Nat. Hist., V, p. 150.
1889. Scenellopora. Miller, North American Geol. Pal., p. 322.
1890. Scenellopora. Ulrich, Geol. Surv. Illinois, VIII, p. 368.
1896. Scenellopora. Ulrich, Zittel's Textb. Pal. (Engl. ed.), p. 268.
1897. Scenellopora. Simpson, Fourteenth Ann. Rep. State Geologist New York for the year 1894, p. 593.

Scenellopora radiata Ulrich.

1882. Scenellopora radiata. Ulrich, Jour. Cincinnati Soc. Nat. Hist., V, p. 158, pl. vi, 6–6*b*.
1897. Scenellopora radiata. Simpson, Fourteenth Ann. Rep. State Geologist New York for the year 1894, figs. 194, 195 (p. 593).
Trenton (Stones River): Knoxville, Tennessee.

CEPTROPORA Ulrich. Genotype: Sceptropora facula Ulrich.
1888. Sceptropora. Ulrich, American Geologist, I, p. 228.
1889. Sceptropora. Ulrich, Contr. Micro-Pal. Cambro-Sil., Part II, p. 46.
1889. Sceptropora. Miller, North American Geol. Pal., p. 322.
1890. Sceptropora. Ulrich, Geol. Sur. Illinois, VIII, p. 400.
1896. Sceptropora. Ulrich, Zittel's Textb. Pal. (Eng. ed.), p. 281.
1897. Sceptropora. Simpson, Fourteenth Ann. Rep. State Geologist New York for the year 1894, p. 548.

ceptropora facula Ulrich.
1888. Sceptropora facula. Ulrich, American Geologist, I, p. 229, fig. 1.
1889. Sceptropora facula. Ulrich, Contr. Micro-Pal. Cambro-Sil., Part II, p. 46, fig. 2.
1890. Sceptropora facula. Ulrich, Geol. Sur. Illinois, VIII, p. 401, fig. 15.
1895. Sceptropora facula. Whiteaves, Pal. Foss., III, Part II, p. 117.
1897. Sceptropora facula. Simpson, Fourteenth Ann. Rep. State Geologist New York for the year 1894, fig. 116 (p. 549).
Cincinnati (Richmond): Stony Mountain, Manitoba; Wilmington and Savannah, Illinois.

ceptropora fustiformis Ulrich.
1889. Sceptropora fustiformis. Ulrich, Contr. Micro-Pal. Cambro-Sil., Part II, p. 46.
Clinton: Hamilton, Ontario.

ELENOPORA Hall. Genotype: Lichenalia circincta Hall.
1886. Selenopora. Hall, Fifth Ann. Rep. State Geologist New York for the year 1885, explanation pl. xxv.
1887. Selenopora. Hall and Simpson, Pal. New York, VI, p. xvii.
1889. Selenopora. Miller, North American Geol. Pal., p. 322.
1890. Selenopora. Ulrich, Geol. Sur. Illinois, VIII, p. 384.
1896. Selenopora. Ulrich, Zittel's Textb. Pal. (Eng. ed.), p. 270.
1897. Selenopora. Simpson, Fourteenth Ann. Rep. State Geologist New York for the year 1894, p. 557.

elenopora circincta (Hall).
1883. Lichenalia circincta. Hall, Trans. Albany Institute, X, p. 153 (abstract, 1881, p. 11).
1886. Selenopora circincta. Hall, Fifth Ann. Rep. State Geologist New York for the year 1885, pl. xxv, 13–15.
1887. Lichenalia (Selenopora) circincta. Hall and Simpson, Pal. New York, VI, p. 86, pl. xxv, 13–15.
1897. Selenopora circincta. Simpson, Fourteenth Ann. Rep. State Geologist New York for the year 1894, pl. xxiv, 4–6.
Hamilton: Falls of the Ohio.

elenopora complexa (Hall).
1883. Lichenalia complexa. Hall, Trans. Albany Institute, X, p. 153 (abstract, 1881, p. 11).
1886. Lichenalia complexa. Hall, Fifth Ann. Rep. State Geologist New York for the year 1885, pl. xxxi, 19, 20.
1887. Lichenalia (Selenopora) complexa. Hall and Simpson, Pal. New York, VI, p. 87, pl. xxxi, 19, 20.
1897. Selenopora complexata. Simpson, Fourteenth Ann. Rep. State Geologist New York for the year 1894, pl. xxiv, 7.
Hamilton: Falls of the Ohio. (In the Trans. Albany Institute, X, p. 153, the locality is given as Onondaga Valley, New York.)

Selenopora complexata Simpson. See Selenopora complexa (Hall).

SEMICOSCINIUM Prout. Genotype: Semicoscinium rhomboideum Prout.

1859. Semicoscinium. Prout, Trans. St. Louis Acad. Sci., I, p. 443.
1886. Semicoscinium. Ulrich, Contr. American Pal., I, p. 4.
1889. Semicoscinium. Miller, North American Geol. Pal., p. 322.
1890. Semicoscinium. Ulrich, Geol. Sur. Illinois, VIII, pp. 395, 555.
1895. Semicoscinium. Simpson, Thirteenth Ann. Rep. New York State Geologist for the year 1893, p. 705; Forty-seventh Ann. Rep. New York State Mus., p. 899.
1896. Semicoscinium. Ulrich, Zittel's Textb. Pal. (Eng. ed.), p. 281.
1897. Semicoscinium. Simpson, Fourteenth Ann. Rep. State Geologist New York for the year 1894, p. 509.
1874. Cryptopora. Nicholson, Canadian Jour., new ser., XIV, p. 131.
1874. Cryptopora. Nicholson, Ann. Mag. Nat. Hist., ser. 4, XIII, p. 77.
1874. Cryptopora. Nicholson, Pal. Province Ontario, p. 102.
1885. Cryptopora. Hall, Rep. State Geologist New York for the year 1884, p. 40.
1886. Cryptopora. Ulrich, Contr. American Pal., I, p. 6.
1874. Carinopora. Nicholson, Canadian Jour., new ser., XIV, p. 132.
1874. Carinopora. Nicholson, Ann. Mag. Nat. Hist., ser. 4, XIII, p. 81.
1874. Carinopora. Nicholson, Pal. Province Ontario, p. 109.
1885. Carinopora. Hall, Rep. State Geologist New York for the year 1884, p. 38.
1886. Carinopora. Ulrich, Contr. American Pal., I, p. 4.
1895. Cycloporina. Simpson, Thirteenth Ann. Rep. State Geologist New York for the year 1893, pp. 711, 725; Forty-seventh Ann. Rep. New York State Mus., pp. 905, 919.
1897. Cycloporina. Simpson, Fourteenth Ann. Rep. State Geologist New York for the year 1894, pp. 504, 520.

Semicoscinium acmeum (Hall).

1876. Fenestella acmea. Hall, Twenty-eighth Ann. Rep. New York State Mus. (documentary edition), pl. xii, 10–13, 14 (sp.?); ibid. (Museum edition, 1879), p. 124, pl. xii, 10–14.
1882. Fenestella acmea. Hall, Eleventh Ann. Rep. Indiana Geol. Nat. Hist. p. 250, pl. xi, 10–14.
1890. Semicoscinium acmea. Ulrich, Geol. Sur. Illinois, VIII, p. 355.
Niagara: Waldron, Indiana.

Semicoscinium biimbricatum (Hall).

1883. Fenestella biimbricata. Hall, Trans. Albany Institute, X, p. 173 (abstract, 1881, p. 31).
1886. Fenestella biimbricata. Hall, Fifth Ann. Rep. State Geologist New York for the year 1885, pl. xlviii, 6–11.
1887. Fenestella biimbricata. Hall and Simpson, Pal. New York, VI, p. 122, pl. xlviii, 6–11.
1897. Fenestella biimbricata. Simpson, Fourteenth Ann. Rep. State Geologist New York for the year 1894, pl. ii, 11.
Hamilton: Falls of the Ohio.

Semicoscinium biserrulatum (Hall).

1883. Fenestella biserrulata. Hall, Trans. Albany Institute, X, p. 172 (abstract, 1881, p. 30).
1886. Fenestella biserrulata. Hall, Fifth Ann. Rep. State Geologist New York for the year 1885, pl. l, 6–11.

Semicoscinium biserrulatum (Hall)—Continued.

1887. Fenestella biserrulata. Hall and Simpson, Pal. New York, VI, p. 128, pl. l, 6–11.
Hamilton: Falls of the Ohio.

Semicoscinium ? cleis (Hall).

1879. Fenestella Cleis. Hall, Thirty-second Ann. Rep. New York State Mus., p. 173 (reprint, 1880, p. 35).
Lower Helderberg: Clarksville, New York.

Semicoscinium coronis (Hall).

1879. Fenestella Coronis. Hall, Thirty-second Ann. Rep. New York State Mus., p. 171 (reprint, 1880, p. 33).
1883. Fenestella Coronis. Hall, Rep. State Geologist New York for the year 1882, pl. xxi, 10–13.
1887. Fenestella Coronis. Hall and Simpson, Pal. New York, VI, p. 51, pl. xxi, 10–13.
Lower Helderberg: Clarksville, New York.

Semicoscinium davidsoni (Nicholson).

1875. Fenestella Davidsoni. Nicholson. Geol. Mag., new ser., II, p. 36, pl. ii, 3–3*b*.
1875. Fenestella Davidsoni. Nicholson, Pal. Province of Ontario, p. 81, pl. iii, 3*a–c*.
Hamilton: Arkona and Widder, Ontario.

Semicoscinium eriense Prout.

1860. Semicoscinium Eriense. Prout, Trans. St. Louis Acad. Sci., I, p. 579.
Devonian (?): Cunningham Island, Lake Erie.

Semicoscinium exornatum (Hall).

1884. Fenestella exornata. Hall, Thirty-sixth Ann. Rep. New York State Mus., p. 67.
1887. Fenestella exornata. Hall, Sixth Ann. Rep. State Geologist New York for the year 1886, p. 49, pl. iv, 6–13, pl. v, 1–13.
1897. Fenestella exornata. Simpson, Fourteenth Ann. Rep. State Geologist New York for the year 1894, pl. ii, 7.
1884. Fenestella brevilinea. Hall, Thirty-sixth Ann. Rep. New York State Mus., p. 70.
Hamilton: Alden and Moscow, New York.

Semicoscinium graniferum (Hall).

1883. Fenestella (Hemitrypa) granifera. Hall, Trans. Albany Institute, X, p. 175 (abstract, 1881, p. 33).
1886. Fenestella (Hemitrypa) granifera. Hall, Fifth Ann. Rep. State Geologist New York for the year 1885, pl. l, 12–14, 16.
1887. Fenestella granifera. Hall and Simpson, Pal. New York, VI, p. 125, pl. l, 12–14, 16.
Upper Helderberg: Near Le Roy, New York.

Semicoscinium hindei (Nicholson).

1874. Carinopora Hindei. Nicholson, Ann. Mag. Nat. Hist., ser. 4, XIII, p. 84, fig. 2.
1874. Carinopora Hindei. Nicholson, Pal. Province Ontario, p. 111, fig. 48.
Upper Helderberg: Jarvis, Ontario.

Semicoscinium inflexum (Hall).

1884. Fenestella inflexa. Hall, Thirty-sixth Ann. Rep. New York State Mus., p. 64.

Hamilton: West Bloomfield, New York.

Semicoscinium infraporosa Ulrich. See Fenestrapora infraporosa (Ulrich).

Semicoscinium interruptum (Hall).

1883. Fenestella interrupta. Hall, Trans. Albany Institute, X, p. 174 (abstract, 1881, p. 32).

1886. Fenestella interrupta. Hall, Fifth Ann. Rep. State Geologist New York for the year 1885, pl. xlviii, 12–17.

1887. Fenestella interrupta. Hall and Simpson, Pal. New York, VI, p. 123, pl. xlviii, 12–17.

Hamilton: Falls of the Ohio.

Semicoscinium labiatum (Hall).

1885. Fenestella labiata. Hall, Rep. State Geologist New York for the year 1884, pl. ii, 18.

1887. Fenestella hemicycla. Hall, Sixth Ann. Rep. State Geologist New York for the year 1886, p. 55, pl. vii, 12, 15, 16 (not 13, 14).

1895. Cycloporina hemicycla. Simpson, Thirteenth Ann. Rep. State Geologist New York for the year 1893, p. 711; Forty-seventh Ann. Rep. New York State Mus., p. 905.

1897. Cycloporina hemicycla. Simpson, Fourteenth Ann. Rep. State Geologist New York for the year 1894, p. 504, pl. iii, 1, 2, 5.

Hamilton: Darien, New York; West Williams, Ontario.

Semicoscinium latijuncturum (Hall).

1883. Fenestella latijunctura. Hall, Trans. Albany Institute, X, p. 173 (abstract, 1881, p. 31).

1886. Fenestella latijunctura. Hall, Fifth Ann. Rep. State Geologist New York for the year 1885, pl. xlviii, 1–5.

1887. Fenestella latijunctura. Hall and Simpson, Pal. New York, VI, p. 128, pl. xlviii, 1–5.

1897. Fenestella latijunctura. Simpson, Fourteenth Ann. Rep. State Geologist New York for the year 1894, pl. ii, 9–10.

Hamilton: Falls of the Ohio.

Semicoscinium lunulatum (Hall).

1883. Fenestella lunulata. Hall, Trans. Albany Institute, X, p. 173 (abstract, 1881, p. 31).

1887. Fenestella lunulata. Hall and Simpson, Pal. New York, VI, p. 121, pl. xlvii, 1–10.

1886. Semicoscinium obliquatum. Ulrich, Contr. American Pal., I, p. 13, pl. i, 5, 5*a*.

Hamilton: Falls of the Ohio.

Semicoscinium mirabile (Nicholson).

1874. Cryptopora mirabile. Nicholson, Ann. Mag. Nat. Hist., ser. 4, XIII, p. 79, fig. 1.

1874. Cryptopora mirabile. Nicholson, Pal. Province Ontario, p. 103, fig. 40.

Upper Helderberg: Port Colborne and Wainfleet, Ontario.

Semicoscinium obliquatum Ulrich. See Semicoscinium lunulatum (Hall.)

nicoscinium permarginatum (Hall).

1883. Fenestella permarginata. Hall, Trans. Albany Institute, X, p. 172 (abstract, 1881, p. 30).
1887. Fenestella permarginata. Hall and Simpson, Pal. New York, VI, p. 127, pl. xlix, 1–10.
Hamilton: Falls of the Ohio.

nicoscinium planodorsatum Ulrich.

1890. Semicoscinium planodorsatum. Ulrich, Geol. Surv. Illinois, VIII, p. 555, pl. xliv, 3–3*b*.
Hamilton: Falls of the Ohio.

nicoscinium rhombicum Ulrich.

1890. Semicoscinium rhombicum. Ulrich, Geol. Surv. Illinois, VIII, p. 556, pl. xliv, 4, 4*a*, pl. liv, 8.
Hamilton: Buffalo, Iowa.

micoscinium rhomboideum Prout.

1859. Semicoscinium rhomboideum. Prout, Trans. St. Louis Acad. Sci., I, p. 443, pl. xvii, 1–1*f*.
1897. Semicoscinium rhomboideum. Simpson, Fourteenth Ann. Rep. State Geologist New York for the year 1894, fig. 58 (p. 509).
Hamilton: Falls of the Ohio.

micoscinium semirotundum (Hall).

1883. Fenestella semirotunda. Hall, Trans. Albany Institute, X, p. 174 (abstract, 1881, p. 32).
1887. Fenestella semirotunda. Hall and Simpson, Pal. New York, VI, p. 125, pl. xlix, 11–22.
1897. Cycloporina semirotunda. Simpson, Fourteenth Ann. Rep. State Geologist New York for the year 1894, pl. iii, 3, 4.
1895. Cycloporina rhomboidea. Simpson, Thirteenth Ann. Rep. State Geologist New York for the year 1893, p. 711; Forty-seventh Ann. Rep. New York State Mus., p. 905.
Hamilton: Falls of the Ohio.

micoscinium subtortile (Hall).

1884. Fenestella subtortilis. Hall, Thirty-sixth Ann. Rep. New York State Mus., p. 71.
1887. Fenestella subtortilis. Hall, Sixth Ann. Rep. State Geologist New York for the year 1886, p. 52.
1888. Fenestella subtortilis. Hall, Seventh Ann. Rep. State Geologist New York for the year 1887, pl. ix, 1–5.
Hamilton: Moscow, New York.

micoscinium tenuiceps (Hall).

1852. Fenestella prisca (?) (not of Lonsdale nor of Goldfuss). Hall, Pal. New York, II, p. 50, pl. xix, 4*a–m*.
1852. Fenestella tenuiceps. Hall, Pal. New York, II, p. 165, pl. xlD, 2*a–b*.
1890. Semicoscinium tenuiceps. Ulrich, Geol. Surv. Illinois, VIII, p. 355.
Niagara: Lockport, New York.

micoscinium thyene (Hall).

1879. Fenestella Thyene. Hall, Thirty-second Ann. Rep. New York State Mus., p. 170 (reprint, 1880, p. 32).
1883. Fenestella Thyene. Hall, Rep. State Geologist New York for the year 1882, pl. xxi, 1–5.

Semicoscinium thyene (Hall)—Continued.

1887. Fenestella Thyene. Hall and Simpson, Pal. New York, VI, p. 50, pl. xxi, 1–5.

1890. Semicoscinium thyene. Ulrich, Geol. Surv. Illinois, VIII, p. 534.
Lower Helderberg: Clarksville, New York.

Semicoscinium tortum (Hall).

1883. Fenestella torta. Hall, Trans. Albany Institute, X, p. 172 (abstract, 1881, p. 30).
Hamilton: Falls of the Ohio.

Semicoscinium tuberculatum Prout.

1859. Semicoscinium tuberculatum. Prout, Trans. St. Louis Acad. Sci., I, p. 579.
Hamilton: Falls of the Ohio.

SEMIOPORA Hall. Genotype: Semiopora bistigmata Hall.

1883. Semiopora. Hall, Trans. Albany Institute, X, p. 193 (abstract, 1881, p. 193).

1884. Semiopora. Hall, Rep. State Geologist New York for the year 1883, p. 51.

1887. Semiopora. Hall and Simpson, Pal. New York, VI, p. xxii.

1889. Semiopora. Miller, North American Geol. Pal., p. 322.

1897. Semiopora. Simpson, Fourteenth Ann. Rep. State Geologist New York for the year 1894, p. 535.

Semiopora bistigmata Hall.

1883. Semiopora bistigmata. Hall, Trans. Albany Institute, X, p. 193 (abstract, 1881, p. 193).

1884. Semiopora bistigmata. Hall, Rep. State Geologist New York for the year 1883, p. 51.

1887. Semiopora bistigmata. Hall and Simpson, Pal. New York, VI, p. 262, pl. xlii, 27–29.

1891. Semiopora bistigmata. Hall, Tenth Ann. Rep. State Geologist New York for the year 1890, p. 52; Forty-fourth Ann. Rep. New York State Mus., p. 82.

1897. Semiopora bistigmata. Simpson, Fourteenth Ann. Rep. State Geologist New York for the year 1894, pl. xi, 10, 11.

1898. Semiopora bistigmata. Whiteaves, Contr. Canadian Pal., I, Part V, p. 377.
Hamilton: West Williams, Ontario.

SEPTOPORA Prout. Genotype: Septopora Cestriensis Prout.

1859. Septopora. Prout, Trans. St. Louis Acad. Sci., I, p. 448.

1882. Septopora. Ulrich, Jour. Cincinnati Soc. Nat. Hist., V, p. 150.

1885. Septopora. Waagen and Pichl., Pal. Indica, Ser. XIII, p. 773.

1886. Septopora. Ulrich, Contr. American Pal., I, p. 6.

1887. Septopora. Foerste, Bull. Sci. Lab. Denison Univ., II, p. 79.

1889. Septopora. Miller, North American Geol. Pal., p. 322.

1890. Septopora. Ulrich, Geol. Surv. Illinois, VIII, pp. 397, 626.

1895. Septopora. Simpson, Thirteenth Ann. Rep. State Geologist New York for the year 1893, pp. 721, 726; Forty-seventh Ann. Rep. New York State Mus., pp. 915, 920.

1895. Septopora. Whidborne, Devon. Fauna England (Pal. Soc. Publ.), II, part 4, p. 183.

1896. Septopora. Ulrich, Zittel's Textb. Pal. (Engl. ed.), p. 283.

1897. Septopora. Simpson, Fourteenth Ann. Rep. State Geologist New York for the year 1894, pp. 514, 521.

ptopora biserialis (Swallow).

1858. Synocladia virgulacea Phillips (?). Swallow, Trans. St. Louis Acad. Sci., I, p. 179.
1858. Synocladia biserialis. Swallow, Trans. St. Louis Acad. Sci., I, p. 179.
1860. Synocladia biserialis. Meek and Hayden, Proc. Acad. Nat. Sci. Philadelphia, p. 24.
1866. Synocladia virgulacea (not of Phillips). Geinitz, Carb. und Dyas in Nebraska, p. 70, pl. v, 14.
1870. Synocladia virgulacea var. biserialis. Meek and Worthen, Geol. Surv. Illinois, V, pl. xxiv, 15*a–c*.
1872. Synocladia biserialis. Meek, Pal. Eastern Nebraska, p. 156, pl. vii, 5*a–e*.
1874. Synocladia biserialis. Meek, American Jour. Sci. Arts., ser. 3, VII, p. 486.
1877. Synocladia biserialis. White, Wheeler's United States Geol. Surv., IV, p. 107, pl. vii, 3*a–c*.
1884. Synocladia biserialis. White, Thirteenth Ann. Rep. Indiana Geol. Nat. Hist., Part 2, p. 138, pl. xxv, 11–13.
1887. Septopora biserialis. Foerste, Bull. Sci. Lab. Denison Univ., II, p. 87; ibid., III, 1888, pl. vii, 16*a–c*.
1888. Synocladia biserialis. Keyes, Proc. Acad. Nat. Sci. Philadelphia, p. 225.
1890. Septopora biserialis. Ulrich, Geol. Surv. Illinois, VIII, p. 631, pl. lvi, 11.
1894. Septopora biserialis. Keyes, Missouri Geol. Surv., V, p. 32, pl. xxxiv, 1*a–d*.
1896. Septopora biserialis. Smith, Proc. American Phil. Soc., XXXV, p. 237.
Coal Measures: Various localities in Kansas, Nebraska, Missouri, Indian Territory, Iowa, Illinois, Ohio, and Kentucky.

ptopora biserialis-gracilis (Meek).

1875. Synocladia biserialis var. gracilis. Meek, Pal. Ohio, II, p. 326, pl. xx, 5–5*b*.
1887. Septopora biserialis var. gracilis. Foerste, Bull. Sci. Lab. Denison Univ., II, p. 80; ibid., III, 1888, pl. vii, 7*a–c*.
Coal Measures: Flint Ridge, Ohio.

ptopora biserialis-nervata Ulrich.

1890. Septopora biserialis var. nervata. Ulrich, Geol. Surv. Illinois, VIII, p. 632, pl. lxiv, 6.
Chester: Kentucky.
Coal Measures: Illinois and near Red Oak, Iowa.

eptopora cestriensis Meek and Worthen (not Prout). See Septopora subquadrans Ulrich.

ptopora cestriensis Prout.

1859. Septopora Cestriensis. Prout, Trans. St. Louis Acad. Sci., I, p. 448, pl. xviii, 2–2*b*.
1890. Septopora cestriensis. Ulrich, Geol. Surv. Illinois, VIII, p. 628, pl. lxiv, 1–1*b*.
1894. Septopora cestriensis. Keyes, Missouri Geol. Surv., V, p. 32.
1897. Septopora cestriensis. Simpson, Fourteenth Ann. Rep. State Geologist New York for the year 1894, fig. 65 (p. 515).
Chester: Chester, Illinois; Sloans Valley and several localities in western Kentucky.

ptopora decipiens Ulrich.

1890. Septopora decipiens. Ulrich, Geol. Sur. Illinois, VIII, p. 630, pl. lxvi, 9.
Chester: Sloans Valley, Kentucky.

Septopora delicatula Ulrich.

1890. Septopora delicatula. Ulrich, Geol. Surv. Illinois, VIII, p. 634, pl. lxiv, 5, 5*a*.

Lower Coal Measures: Seville, Illinois.

Septopora pinnata Ulrich.

1890. Septopora pinnata. Ulrich, Geol. Surv. Illinois, VIII, p. 633, pl. lxiv, 7, pl. lxv, 1, 1*a*.

Upper Coal Measures: Jasper County, Illinois.

Septopora rectistyla (Whitfield).

1882. Synocladia rectistyla. Whitfield, Annals New York Acad. Sci., II, p. 220.

1891. Septopora rectistyla. Whitfield, Annals New York Acad. Sci., V, p. 579, pl. xiii, 9, 10.

1895. Synocladia rectistyla. Whitfield, Geol. Sur. Ohio, VII, p. 467, pl. ix, 9, 10.

Chester: Newtonville, Ohio.

Septopora robusta Ulrich.

1890. Septopora robusta. Ulrich, Geol. Sur. Illinois, VIII, p. 633, pl. lvi, 9–9*c*, pl. lxiv, 3, 3*a*.

Upper Coal Measures: Fayette County, Illinois.

Septopora robusta-intermedia Ulrich.

1890. Septopora robusta var. intermedia. Ulrich, Geol. Sur. Illinois, VIII, p. 634, pl. lvi, 10, pl. lxiv, 4, 4*a*.

Chester: Litchfield and Sloans Valley, Kentucky.

Septopora subquadrans Ulrich.

1870. Septopora cestriensis (not of Prout). Meek and Worthen, Proc. Acad. Nat. Sci. Philadelphia, p. 15.

1870. Septopora cestriensis (not of Prout). Meek and Worthen, Geol. Sur. Illinois, V, pl. xxiv, 14 *a–c*.

1874. Septopora cestriensis (not of Prout). Meek, American Jour. Sci. Arts, ser. 3, VII, p. 486.

1890. Septopora subquadrans. Ulrich, Geol. Sur. Illinois, VIII, p. 629, pl. lvi. 7, 8, pl. lxiv, 2–2*b*.

Chester: Chester, Illinois; Sloans Valley, and other localities in Kentucky.

SPATIOPORA Ulrich. Genotype: Spatiopora aspera Ulrich.

1882. Spatiopora. Ulrich, Jour. Cincinnati Soc. Nat. Hist., V, p. 155; ibid, VI, 1883, p. 166.

1883. Spatiopora. Foord, Contr. Micro-Pal. Cambro-Sil., p. 20.

1889. Spatiopora. Miller, North American Geol. Pal., p. 323.

1890. Spatiopora. Ulrich, Geol. Sur. Illinois, VIII, p. 381.

1893. Spatiopora. Ulrich, Geol. Minnesota, III, p. 319.

1896. Spatiopora. Ulrich, Zittel's Textb. Pal. (Eng. ed.), p. 269.

Spatiopora ? areolata Foord.

1883. Spatiopora areolata. Foord, Contr. Micro-Pal. Cambro-Sil., p. 21, pl. v, 1–1*i*.

Trenton: Hull, Quebec.

Spatiopora aspera Ulrich.

1883. Spatiopora aspera. Ulrich, Jour. Cincinnati Soc. Nat. Hist., VI, p. 166, pl. vii, 5–5*b*.

1895. Monticulipora aspera. J. F. James, Jour. Cincinnati Soc. Nat. Hist., XVIII, p. 82.

1896. Spatiopora aspera. Ulrich, Zittel's Textb. Pal. (Eng. ed.), fig. 441 (p. 269).

Cincinnati (Lorraine): Hamilton and Cincinnati, Ohio.

patiopora corticans (Nicholson).

1874. Chætetes corticans. Nicholson, Quar. Jour. Geol. Soc. London, XXX, p. 512, pl. xix, 13, 14.
1875. Chætetes corticans. Nicholson, Pal. Ohio, II, p. 210, pl. xxii, 6, 6*a*.
1876. Chætetes tuberculatus (not of Milne-Edwards and Haime). Nicholson, Ann. Mag. Nat. Hist., ser. 4, XVIII, p. 91.
1881. Monticulipora (Monotrypa) tuberculata (not of Milne-Edwards and Haime). Nicholson, Genus Monticulipora, p. 200, pl. iv, 2–2*d*.
Cincinnati (Lorraine and Richmond): Cincinnati, Warren, and Clinton counties, Ohio; Richmond and Versailles, Indiana.
Obs. This species has been considered synonymous with Spatiopora tuberculata (Milne-Edwards and Haime), but investigations show that it can be distinguished by several important and reliable characters.

patiopora iowensis Ulrich.

1893. Spatiopora iowensis. Ulrich, Geol. Minnesota, III, p. 321.
Cincinnati (Utica): Graf and Lantnerville, Iowa.

patiopora labeculosa Ulrich.

1893. Spatiopora labeculosa. Ulrich, Geol. Minnesota, III, p. 320, pl. xxviii, 1, 2.
Trenton (Black River): Minneapolis, St. Paul, and Fountain, Minnesota.

patiopora lineata Ulrich.

1883. Spatiopora lineata. Ulrich, Jour. Cincinnati Soc. Nat. Hist., VI, p. 167, pl. vii, 7.
Cincinnati (Lorraine): Hamilton and Cincinnati, Ohio.

patiopora lineata-incepta Ulrich.

1893. Spatiopora maculosa var. incepta. Ulrich, Geol. Minnesota, III, p. 320.
Trenton (Black River): Chatfield, Minnesota.

atiopora maculosa Ulrich.

1883. Spatiopora maculosa. Ulrich, Jour. Cincinnati Soc. Nat. Hist., VI, p. 167, pl. vii, 6.
Cincinnati (Lorraine): Cincinnati, Ohio, and vicinity.

patiopora maculosa var. incepta Ulrich. See Spatiopora lineata-incepta Ulrich.

atiopora montifera Ulrich.

1883. Spatiopora montifera. Ulrich, Jour. Cincinnati Soc. Nat. Hist., VI, p. 168, pl. vi, 1, 1*a*, pl. vii, 8.
Cincinnati (Richmond): Waynesville, Clarksville, and Oxford, Ohio.

atiopora tuberculata (Milne-Edwards and Haime).

1851. Chætetes tuberculatus. Milne-Edwards and Haime, Pol. Foss. Terr. Pal., p. 268, pl. xix, 3, 3*a*.
1883. Monticulipora tuberculata. Hall, Twelfth Ann. Rep. Indiana Geol. Nat. Hist., p. 251, pl. x, 6.
1883. Spatiopora tuberculata. Ulrich, Jour. Cincinnati Soc. Nat. Hist., VI, p. 166.
1888. Monticulipora tuberculata. James and James, Jour. Cincinnati Soc. Nat. Hist., XI, p. 21.
1895. Monticulipora tuberculata. J. F. James, Jour. Cincinnati Soc. Nat. Hist., XVI, p. 78.
Cincinnati (Lorraine and Richmond): Cincinnati, Waynesville, and other localities in Ohio.

SPHRAGIOPORA Ulrich. Genotype: Sphragiopora parasitica Ulrich.

1890. Sphragiopora. Ulrich, Geol. Surv. Illinois, VIII, pp. 398, 638.
1889. Sphragiopora. (Ulrich, in press), Miller, North American Geol. Pal., p. 323.
1897. Sphragiopora. Simpson, Fourteenth Ann. Rep. State Geologist New York for the year 1894, p. 594.

Sphragiopora parasitica Ulrich.

1890. Sphragiopora parasitica. Ulrich, Geol. Sur. Illinois, VIII, p. 638, pl. lxv, 6, 6*a*.
1894. Sphragiopora parasitica. Keyes, Missouri Geol. Sur., V, p. 33.
1897. Sphragiopora parasitica. Simpson, Fourteenth Ann. Rep. State Geologist New York, for the year 1894, fig. 196 (p. 594).
Chester: Chester, Illinois.

Stellipora Milne-Edwards and Dybowski (not Hall). See Constellaria Dana.

STELLIPORA Hall. Genotype: Stellipora antheloidea Hall.

1847. Stellipora. Hall, Pal. New York, I, p. 79.
1850. Stellipora. D'Orbigny, Prodr. de Pal., I, p. 22.
1877. Stellipora (in part). Dybowski, Die Chætetiden d. Ostbaltischen Silur-Form., p. 42.
1882. Stellipora. Ulrich, Jour. Cincinnati Soc. Nat. Hist., V, p. 155; ibid., VI, 1883, p. 263.
1889. Stellipora (in part). Miller, North American Geol. Pal., p. 203.
1890. Stellipora. Ulrich, Geol. Surv. Illinois, VIII, p. 374.
1896. Stellipora. Ulrich, Zittel's Textb. Pal. (Engl. ed.), p. 276.

Stellipora antheloidea Hall.

1847. Stellipora antheloidea. Hall, Pal. New York, I, p. 79, pl. xxvi, 10*a*–*c*.
1883. Stellipora antheloidea. Ulrich, Jour. Cincinnati Soc. Nat. Hist., VI, p. 263, pl. xiv, 1, 1*a*.
1888. Monticulipora (Constellaria) antheloidea (in part). James and James, Jour. Cincinnati Soc. Nat. Hist., XI, p. 31.
Trenton: Lowville, New York; Ottawa, Canada.

Stellipora antheloidea D'Orbigny (not Hall). See Constellaria constellata (Van Cleve) Dana.

Stellipora (Constellaria) antheloidea Rominger. See Constellaria constellata (Van Cleve) Dana.

Stellipora limitaris Ulrich. See Constellaria limitaris (Ulrich).

STENOPORA Lonsdale. Genotype: Stenopora tasmaniensis Lonsdale.

1844. Stenopora. Lonsdale, Darwin's Volcanic Islands, Appendix, p. 161.
1845. Stenopora. Lonsdale, Strzelecki's Physical Description New South Wales, p. 262.
1845. Stenopora. Lonsdale, Geol. Russia and Ural Mountains, I, p. 631.
1850. Stenopora. King, Monograph Perm. Foss. England, p. 28.
1852. Stenopora. McCoy, Brit. Pal. Foss., p. 24.
1860. Stenopora. Eichwald, Lethæa Rossica, I, p. 414.
1874. Stenopora. Miller, Cincinnati Quar. Jour. Sci., I, p. 368.
1876. Stenopora. Dybowski, Verh. d. k. Min. Ges. St. Petersburg, ser. 2, X, p. 180.
1879. Stenopora. Nicholson and Etheridge, Jun., Ann. Mag. Nat. Hist., ser. 5, IV, p. 265.
1879. Stenopora. Nicholson, Pal. Tabulate Corals, p. 168.
1882. Stenopora. Ulrich, Jour. Cincinnati Soc. Nat. Hist., V, p. 154.

ENOPORA Lonsdale—Continued.

1886. Stenopora. Nicholson and Etheridge, Jun., Ann. Mag. Nat. Hist., ser. 5, XVII, pp. 173–187.

1886. Stenopora. Waagen and Wentzel, Pal. Indica, Ser. XIII, pp. 875, 885.

1887. Stenopora. Foerste, Bull. Sci. Lab. Denison Univ., II, p. 85.

1889. Stenopora. Miller, North American Geol. Pal., p. 203.

1890. Stenopora. Ulrich, Geol. Surv. Illinois, VIII, pp. 375, 436.

1896. Stenopora. Zittel's Textb. Pal. (Engl. Ed.), p. 105.

1896. Stenopora. Ulrich, Zittel's Textb. Pal. (Engl. ed.), p. 277.

1897. Stenopora. Simpson, Fourteenth Ann. Rep. State Geologist New York for the year 1894, p. 583.

1883. Tabulipora. Young, Ann. Mag. Nat. Hist., ser. 5, XII, p. 154.

1844. Tubuliclidia. Lonsdale, Bull. Soc. Geol. France, ser. 2, I, p. 497.

1845. Tubuliclidia. Lonsdale, Murchison's Geol. Russia, pp. 221, 631.

enopora adherens Billings. Not recognizable.

1859. Stenopora adherens. Billings, Canadian Nat. Geol., IV, p. 427.

Chazy: Mingan Islands, Canada.

enopora americana Ulrich.

1890. Stenopora americana. Ulrich, Geol. Surv. Illinois, VIII, p. 437, pl. lxxiv, .1, 1*a*, fig. 4*b* (p. 309).

1894. Stenopora americana. Keyes, Missouri Geol. Surv., V, p. 14.

1896. Stenopora americana. Ulrich, Zittel's Textb. Pal. (Engl. ed.), fig. 464, (p. 277).

Keokuk: Warsaw, and Jersey County, Illinois.

enopora americana-varsoviensis Ulrich.

1890. Stenopora americana var. varsoviensis. Ulrich, Geol. Surv. Illinois, VIII, p. 437, pl. lxxiv, 3, 3*a*.

Warsaw: Warsaw, Illinois.

enopora angularis Ulrich.

1890. Stenopora angularis. Ulrich, Geol. Surv. Illinois, VIII, p. 439, pl. lxxiv, 6–6*b*.

1894. Stenopora angularis. Keyes, Missouri Geol. Surv., V, p. 15.

Keokuk: Lagrange, Missouri.

enopora bulbosa Billings. Not recognizable.

1865. Stenopora bulbosa. Billings, Canadian Nat. Geol., ser. 2, II, p. 429.

1866. Stenopora bulbosa. Billings, Catal. Sil. Foss. Anticosti, p. 32.

Anticosti: Anticosti Island.

enopora carbonaria (Worthen).

1875. Chætetes ? carbonaria. Worthen, Geol. Surv. Illinois, VI, p. 526, pl. xxxii, 5.

1887. Stenopora carbonaria. Foerste, Bull. Sci. Lab. Denison Univ., II, p. 85; ibid., III, 1888, pl. viii, 13*a–c*.

1890. Stenopora carbonaria. Ulrich, Geol. Surv. Illinois, VIII, p. 445, pl. lxxiii, 8, 8*a*.

Coal Measures: Caseyville and Peoria, Illinois; Lawrence, Kansas; Licking County, Ohio.

enopora carbonaria-conferta Ulrich.

1890. Stenopora carbonaria var. conferta. Ulrich, Geol. Surv. Illinois, VIII, p. 446, pl. lxxiii, 9, 9*a*.

Coal Measures: Caseyville, Illinois.

Stenopora carbonaria-maculosa Ulrich.

1890. Stenopora carbonaria var. maculosa. Ulrich, Geol. Surv. Illinois, VIII, p. 445, pl. lxxiii, 10, 10*a*.

Coal Measures: Caseyville, Illinois.

Stenopora cestriensis Ulrich.

1890. Stenopora cestriensis. Ulrich, Geol. Surv. Illinois, VIII, p. 442, pl. lxxiv, 7, 7*a*.

1894. Stenopora cestriensis. Keyes, Missouri Geol. Surv., V, p. 16.

Chester: Chester, Illinois; Smithland, Sloans Valley, and Caldwell County, Kentucky.

Stenopora emaciata Ulrich.

1890. Stenopora emaciata. Ulrich, Geol. Surv. Illinois, VIII, p. 438, pl. lxxiv, 2, 2*a*.

1894. Stenopora emaciata. Keyes, Missouri Geol. Surv., V, p. 15.

Keokuk: Warsaw, Illinois; Keokuk, Iowa.

Stenopora exilis Dawson. See Rhombopora exilis (Dawson).

Stenopora fibrosa Billings (not Goldfuss?).

1863. Stenopora fibrosa. Billings, Geol. Canada, p. 156, fig. 116.

1866. Stenopora fibrosa. Billings, Catal. Sil. Foss. Anticosti, p. 32.

Trenton: Canada.

Obs. A. H. Foord (Contr. Micro-Pal. Cambro-Sil., p. 15) says this is probably Monotrypella (now Eridotrypa) trentonensis (Nicholson).

Stenopora huronensis Billings. Not a bryozoan.

1865. Stenopora huronensis. Billings, Pal. Foss., I, p. 185.

Obs. This is a species of Tetradium according to A. H. Foord.

Stenopora intercalaris Ulrich.

1890. Stenopora intercalaris. Ulrich, Geol. Surv. Illinois, VIII, p. 439, pl. lxxiv, 5, 5*a*.

1894. Stenopora intercalaris. Keyes, Missouri Geol. Surv., V, p. 15.

1897. Stenopora intercalaris. Simpson, Fourteenth Ann. Rep. State Geologist New York for the year 1894, figs. 160, 161 (p. 584).

Keokuk: Warsaw, Illinois.

Stenopora intermittens Ulrich.

1890. Stenopora intermittens. Ulrich, Geol. Surv. Illinois, VIII, p. 440, fig. 16.

1894. Stenopora intermittens. Keyes, Missouri Geol. Surv., V, p. 15.

Keokuk: Warsaw, Illinois.

Stenopora libana Safford. Not recognized.

1869. Stenopora libana. Safford, Geol. Tennessee, p. 285.

Stenopora meekana Ulrich.

1890. Stenopora meekana. Ulrich, Geol. Surv. Illinois, VIII, p. 443, pl. lxxiii, 7, 7*a*.

1894. Stenopora meekana. Keyes, Missouri Geol. Surv., V, p. 16.

Chester: Chester, Illinois; Sloans Valley, Kentucky.

Stenopora montifera Ulrich.

1890. Stenopora montifera. Ulrich, Geol. Surv. Illinois., VIII, p. 438, pl. lxxiv, 4–4*b*.

1894. Stenopora montifera. Keyes, Missouri Geol. Surv., V, p. 14.

Keokuk: Otter Creek, Jersey County, Illinois; Bentonsport, Iowa.

enopora ohioensis Foerste.

1887. Stenopora ohioensis. Foerste, Bull. Sci. Lab. Denison Univ., II, p. 85; ibid., III, 1888, pl. viii, 12*a–e*.
Coal Measures: Flint Ridge, Ohio.

tenopora patula Billings. Not recognizable.

1859. Stenopora patula. Billings, Canadian Nat. Geol., IV, p. 427
Chazy: Island of Montreal and Mingan Islands, Canada.

enopora ramosa Ulrich.

1890. Stenopora ramosa. Ulrich, Geol. Surv. Illinois., VIII, p. 442, pl. lxxiii, 6–6*c*.
Chester: Sloans Valley and Grayson Springs, Kentucky; Chester, Illinois.

enopora rudis Ulrich.

1890. Stenopora rudis. Ulrich, Geol. Surv. Illinois, VIII, p. 444, pl. lxxii, 8–8*b*.
Chester: Sloans Valley, Kentucky.

enopora ? signata Ulrich.

1890. Stenopora ? signata. Ulrich, Geol. Surv. Illinois, VIII, p. 446, pl. lxxiii, 5–5*b*.
Coal Measures: Caseyville, Illinois.

enopora tuberculata (Prout).

1859. Flustra tuberculata. Prout, Trans. St. Louis Acad. Sci., I, p. 447, pl. xvii, 3–3*f*.
1890. Stenopora tuberculata. Ulrich, Geol. Surv. Illinois, VIII, p. 441, fig. 17, fig. 5*c* (p. 315).
1894. Stenopora tuberculata. Keyes, Missouri Geol. Surv., V, p. 15.
1860. Cyclopora polymorpha. Prout, Trans. St. Louis Acad. Sci., I, p. 578.
1866. Cyclopora polymorpha. Prout, Geol. Surv. Illinois, II, p. 421, pl. xxi, 5–5*b*.
Warsaw: Barretts Station, Missouri (Prout), and elsewhere.
St. Louis: Several localities.
Chester: Pope County (Prout) and Chester, Illinois; Grayson Springs and Sloans Valley, Kentucky, and many other localities.

tictocella Simpson. See Cystodictya Ulrich.

tictocella interstriata Simpson. See Stictopora ?? interstriata Hall.

tictocella sinuosa Simpson. See Cystodictya sinuosa (Hall).

TICTOPORA Hall. Genotype: Stictopora elegantula Hall.

1847. Stictopora. Hall, Pal. New York, I, p. 73.
1879. Stictopora (in part). Hall, Twenty-eighth Ann. Rep. New York State Mus., p. 122.
1882. Stictopora (in part). Hall, Eleventh Ann. Rep. Indiana Geol. Nat. Hist., p. 247.
1889. Stictopora (in part). Miller, North American Geol. Pal., p. 323.
1897. Stictopora (in part). Simpson, Fourteenth Ann. Rep. State Geologist New York for the year 1894, p. 605.
Not Stictopora. Eichwald, Lethæa Rossica, I, p. 390.
Not Stictopora. Ulrich, Jour. Cincinnati Soc. Nat. Hist., V, 1882, pp. 152, 168 (=Rhinidictya).
Not Stictopora. Hall and Simpson, Pal. New York, VI, 1887, p. xx (=Cystodictya).
Not Stictopora. Ulrich, Geol. Surv. Illinois, VIII, 1890, p. 388 (=Rhinidictya).

STICTOPORA Hall—Continued.

1897. Not Stictopora. Grabau, Bull. Buffalo Soc. Nat. Sci., VI, 1899, p. 172 (=Cystodictya).

Obs. This name has been applied to a number of unrelated forms. A description and figures of the internal structure of the genotype have never been published. Thin sections of S. elegantula show that the genus is related to both Stictoporella and Tæniodictya. It resembles the former in the long primitive portion of the zooecial tubes, but is distinguished by the well-marked peristomes and absence of mesopores. From the latter it differs in the absence of hemisepta, the presence of peristomes, and the long primitive portion of the zooecial tubes.

Stictopora? acuta Hall. See Pachydictya acuta (Hall).

Stictopora acuta Ulrich. See Pachydictya acuta (Hall).

Stictopora alternata Hall and Simpson. Not recognizable.

1887. Stictopora alternata. Hall and Simpson, Pal. New York, VI, pl. xxiii A, 21. (Not described.)

Lower Helderberg: Clarksville, New York.

Stictopora angularis Hall. See Cystodictya tumulosa (Hall).

Stictopora basalis Ulrich. See Rhinidictya basalis (Ulrich).

Stictopora bifurcata Hall. See Cystodictya bifurcata (Hall).

Stictopora bifurcata (Van Cleve) Hall. See Pachydictya bifurcata (Hall).

Stictopora bristolensis Miller. See Cystodictya bifurcata (Hall).

Obs. The name bristolensis was proposed by S. A. Miller (North American Geol. Pal., p. 323) for Stictopora bifurcata Hall, which he considered preoccupied.

Stictopora clathratula James. See Escharopora pavonia (D'Orbigny).

Stictopora (Stictoporina) claviformis Hall and Simpson. See Stictoporina claviformis (Hall).

Stictopora compressa (Van Cleve) Hall. See Phænopora magna Hall and Whitfield.

Stictopora crassa Hall. See Pachydictya crassa (Hall).

Stictopora crenulata Hall. See Cystodictya subrigida (Hall).

Stictopora crescens Hall. See Cystodictya crescens (Hall).

Stictopora crispata Quenstedt. See Cystodictya gilberti (Meek).

Stictopora dichotoma Hall. See Tæniopora subcarinata (Hall).

Stictopora ?? divergens Hall and Simpson.

1887. Stictopora divergens. Hall and Simpson, Pal. New York, VI, p. 257, pl. lxiii, 18, 19.

1891. Stictopora divergens. Hall. Tenth Ann. Rep. State Geologist New York for the year 1890, p. 49; Forty-fourth Ann. Rep. New York State Mus., p. 79.

Hamilton: Darien Center, New York.

Stictopora elegantula Hall.

1847. Stictopora elegantula. Hall, Pal. New York, I, p. 75, pl. xxvi, 4*a*–*g*.

Trenton: Middleville, Trenton Falls, and other localities in New York.

Obs. See remarks under Stictopora.

Stictopora fenestrata Hall. See Rhinidictya fenestrata (Hall).

Stictopora fidelis Ulrich. See Rhinidictya fidelis (Ulrich).

tictopora fidelis Ulrich, 1886 (in part). See Rhinidictya trentonensis (Ulrich).

tictopora fragilis Whitfield. See Dicranopora fragilis (Billings).

tictopora ?? fruticosa Hall.
1883. Stictopora fruticosa. Hall, Trans. Albany Institute, X, p. 56 (abstract, 1881, p. 14).
1883. Stictopora fruticosa. Hall, Rep. State Geologist New York for the year 1882, pl. xxv, 12–14.
1887. Stictopora fruticosa. Hall and Simpson, Pal. New York, VI, p. 92, pl. xxviii, 12–14.
Upper Helderberg: New York.

tictopora Gilberti Hall. See Cystodictya gilberti (Meek).

tictopora ? glomerata Hall.
1847. Stictopora glomerata. Hall, Pal. New York, I, p. 17, pl. iv, 5.
Chazy: Granville, Vermont.

Stictopora graminifolia Ringueberg. Recognizable ?
1884. Stictopora graminifolia. Ringueberg, Proc. Acad. Nat. Sci. Philadelphia, p. 147, pl. iii, 4.
Niagara (Transitional): Gasport, New York.

tictopora ?? granatula Hall.
1883. Trematopora rhombifera (in part). Hall, Rep. State Geologist New York for the year 1882, pl. xi, 16.
1887. Stictopora granatula. Hall and Simpson, Pal. New York, VI, p. 38, pl. xi, 16; pl. xxiii A, 17.
Lower Helderberg: Catskill Creek and Clarksville, New York.

tictopora ?? granifera Hall.
1883. Stictopora granifera. Hall. Trans. Albany Institute, X, p. 191 (abstract, 1881, p. 191).
1884. Stictopora granifera. Hall, Rep. State Geologist New York for the year 1883, p. 45.
1887. Stictopora granifera. Hall and Simpson, Pal. New York, VI, p. 257, pl. lxi, 1–6.
1891. Stictopora granifera. Hall, Tenth Ann. Rep. State Geologist New York for the year 1890, p. 49; Forty-fourth Ann. Rep. New York State Mus., p. 79.
Hamilton: Pavilion and Muttonville, New York.

Stictopora incisurata Hall. See Cystodictya incisurata (Hall).

tictopora ?? incrassata Hall.
1883. Stictopora incrassata. Hall, Trans. Albany Institute, X, p. 190 (abstract, 1881, p. 190).
1884. Stictopora incrassata. Hall, Rep. State Geologist New York for the year 1883, p. 47.
1887. Stictopora incrassata. Hall and Simpson, Pal. New York, VI, p. 249, pl. lxii, 1–6.
1891. Stictopora incrassata. Hall, Tenth Ann. Rep. State Geologist New York for the year 1890, p. 43; Forty-fourth Ann. Rep. New York State Mus., p. 73.
1898. Cystodictya ? incrassata. Whiteaves, Contr. Canadian Pal., I, p. 377.
Hamilton: West Williams, Ontario.

Stictopora indenta Hall. See Cystodictya incisurata (Hall).

Stictopora ?? interstriata Hall.

1883. Stictopora interstriata. Hall, Trans. Albany Institute, X, p. 191 (abstract, 1881, p. 191).
1884. Stictopora interstriata. Hall, Rep. State Geologist New York for the year 1883, p. 45.
1887. Stictopora interstriata. Hall and Simpson, Pal. New York, VI, p. 259, pl. lxii, 7-12.
1891. Stictopora interstriata. Hall, Tenth Ann. Rep. State Geologist New York for the year 1890, p. 51; Forty-fourth Ann. Rep. New York State Mus., p. 81.
1897. Stictocella interstriata. Simpson, Fourteenth Ann. Rep. State Geologist New York for the year 1894, pl. x, 6, 7. [Note: Figure 6 is given in Pal. New York, VI, pl. lxi, 2, as Stictopora granifera.]

Hamilton: Fallbrook, New York.

Stictopora invertis Hall. See Cystodictya ? invertis (Hall).

Stictopora ? labyrinthica Hall.

1847. Stictopora labyrinthica. Hall, Pal. New York, I, p. 50, pl. xii, *8a*, *b*, and woodcut on p. 50.

Trenton (Stones River): Chazy and Watertown, New York.

Obs. This form may prove to be a Phyllodictya.

Stictopora limata Hall. See Cystodictya limata (Hall).

Stictopora linearis Hall. See Cystodictya linearis (Hall).

Stictopora lobata Hall. See Euspilopora lobata (Hall).

Stictopora magna Hall and Whitfield. See Phænopora magna (Hall and Whitfield).

Stictopora multifida (Van Cleve) Hall. See Phænopora multifida (Hall).

Stictopora multipora Hall. See Cystodictya incisurata (Hall).

Stictopora mutabilis Ulrich. See Rhinidictya mutabilis (Ulrich).

Stictopora mutabilis var. major Ulrich. See Rhinidictya mutabilis-major (Ulrich).

Stictopora mutabilis var. minor Ulrich. See Rhinidictya mutabilis (Ulrich).

Stictopora obliqua Hall. See Cystodictya incisurata (Hall).

Stictopora obliqua Ringueberg. See Ptilodictya obliqua (Ringueberg).

Stictopora ?? obsoleta Hall and Simpson.

1887. Stictopora obsoleta. Hall and Simpson, Pal. New York, VI, p. 37, pl. xxiiiA, 22.

Lower Helderberg: Clarksville, New York.

Obs. Probably a synonym for Stictopora ?? papillosa Hall.

Stictopora orbipora Hall. See Stictotrypa orbipora (Hall.)

Stictopora ovata Hall. See Cystodictya ovata (Hall).

Stictopora ovatipora Hall. See Cystodictya ? ovatipora (Hall).

Stictopora ovatipora Miller (not Hall). See Stictotrypa similis (Hall).

Stictopora palmipes Hall. See Euspilopora palmipes (Hall).

Stictopora ?? papillosa Hall.

1879. Stictopora papillosa. Hall, Thirty-second Ann. Rep. New York State Mus., p. 161 (reprint, 1880, p. 23).
1883. Stictopora papillosa. Hall, Rep. State Geologist New York for the year 1882, pl. xiii, 12, 13.

Stictopora ?? papillosa Hall—Continued.

1887. Stictopora papillosa. Hall and Simpson, Pal. New York, VI, p. 37, pl. xiii, 12, 13, pl. xxiiiA, 16.

Lower Helderberg: Clarksville, New York.

Stictopora paupera Ulrich. See Rhinidictya paupera (Ulrich) and Rhinidictya neglecta (Ulrich).

Stictopora perarcta Hall. See Cystodictya perarcta (Hall).

Stictopora ?? permarginata Hall.

1883. Stictopora permarginata. Hall, Trans. Albany Institute, X, p. 191 (abstract, 1881, p. 191).

1884. Stictopora permarginata. Hall, Rep. State Geologist New York for the year 1883, p. 46.

1887. Stictopora permarginata. Hall and Simpson, Pal. New York, VI, p. 258, pl. lxiii, 16.

1891. Stictopora permarginata. Hall, Tenth Ann. Rep. State Geologist New York for the year 1890, p. 50; Forty-fourth Ann. Rep. New York State Mus., p. 80.

1899. Stictopora permarginata. Grabau, Bull. Buffalo Soc. Nat. Sci., VI, p. 174, fig. 70.

Hamilton: Hamburg, New York.

Stictopora punctipora Hall. See Stictotrypa punctipora (Hall).

Stictopora ? ramosa Hall.

1847. Stictopora ramosa. Hall, Pal. New York, I, p. 51, pl. xii, 6, 7, 7*a*, and woodcut on p. 51.

Trenton (Stones River): ? Watertown, New York.

Stictopora raripora Hall. See Nematopora raripora (Hall).

Stictopora recta Hall. See Cystodictya ? recta Hall.

Stictopora rectalinea Hall. See Cystodictya rectilinea (Hall.)

Stictopora rectilatera Hall. See Cystodictya linearis (Hall).

Stictopora recubans Hall and Simpson. See Tæniopora recubans (Hall and Simpson).

Stictopora rhomboidea Hall. See Tæniodictya ? rhomboidea (Hall).

Stictopora rigida Hall. See Cystodictya rigida (Hall).

Stictopora scitula Hall and Simpson. See Pachydictya crassa (Hall).

Stictopora ? scutulata Hall. See Stictoporina scutulata (Hall).

Stictopora semistriata Hall. See Cystodictya semistriata (Hall).

Stictopora similis Hall. See Stictotrypa similis (Hall).

Stictopora sinuosa Hall. See Cystodictya sinuosa (Hall).

Stictopora ?? striata Hall and Simpson.

1887. Stictopora striata. Hall and Simpson, Pal. New York, VI, p. 246, pl. lxiii, 22.

1888. Stictopora striata. Herrick, Bull. Sci. Lab. Denison Univ., III, pl. xii, 40, 40*a*.

1891. Stictopora striata. Hall, Tenth Ann. Rep. State Geologist New York for the year 1890, p. 42; Forty-fourth Ann. Rep. New York State Mus., p. 72.

Hamilton: Ontario County, New York. A form from the Waverly at Moots Run, Ohio, has been identified by Herrick as this species, but the identification is certainly incorrect.

Stictopora ? subcarinata Hall. See Tæniopora subcarinata (Hall).

Stictopora subrigida Hall. See Cystodictya subrigida (Hall).
Stictopora sulcata Winchell. See Cystodictya sulcata (Winchell).
Stictopora trilineata Hall. See Cystodictya trilineata (Hall).
Stictopora ? triserialis Hall. See Acanthoclema triseriale (Hall).
Stictopora tumulosa Hall. See Cystodictya tumulosa (Hall).
Stictopora Vanclevii Hall. See Phænopora fimbriata (James).
Stictopora vermicula Hall. See Cystodictya vermicula (Hall).

STICTOPORELLA Ulrich. Genotype: Stictoporella interstincta Ulrich =Ptilodictya flexuosa James.

1882. Stictoporella. Ulrich, Jour. Cincinnati Soc. Nat. Hist., V, pp. 152, 169.
1889. Stictoporella. Miller, North American Geol. Pal., p. 325.
1890. Stictoporella. Ulrich, Geol. Sur. Illinois, VIII, p. 394.
1893. Stictoporella. Ulrich, Geol. Minnesota, III, p. 179.
1896. Stictoporella. Ulrich, Zittel's Textb. Pal. (Engl. ed.), p. 279.
1897. Stictoporella. Simpson, Fourteenth Ann. Rep. State Geologist New York for the year 1894, p. 535.

Stictoporella angularis Ulrich.

1886. Stictoporella angularis. Ulrich, Fourteenth Ann. Rep. Geol. Nat. Hist. Sur. Minnesota, p. 71.
1893. Stictoporella angularis. Ulrich, Geol. Minnesota, III, p. 182, pl. xi, 1-3, 6, 8-11.
Trenton (Stones River): Minneapolis, St. Paul, Goodhue, and Fillmore counties, Minnesota.

Stictoporella angularis-intermedia Ulrich.

1893. Stictoporella angularis var. intermedia. Ulrich, Geol. Minnesota, III, p. 183, pl. xi, 4, 5, 7.
Trenton (Stones River): Minneapolis, Fountain, Lanesboro, and Preston, Minnesota; Decorah, Iowa.

Stictoporella basalis Ulrich. See Intrapora basalis (Ulrich).

Stictoporella cribrosa Ulrich.

1886. Stictoporella ? cribrosa. Ulrich, Fourteenth Ann. Rep. Geol. Nat. Hist. Sur. Minnesota, p. 69.
1893. Stictoporella cribrosa. Ulrich, Geol. Minnesota, III, p. 184, pl. x, 21-25, pl. xi, 22, 23.
1897. Stictoporella cribrosa. Simpson, Fourteenth Ann. Rep. State Geologist New York for the year 1894, fig. 93 (p. 536).
Trenton (Stones River and Black River): Minneapolis and St. Paul, Minnesota.

Stictoporella dumosa Ulrich.

1893. Stictoporella dumosa. Ulrich, Geol. Minnesota, III, p. 181.
Trenton (Black River): St. Paul, Minnesota.

Stictoporella ? excellens Ulrich. See Phænopora excellens (Billings).

Stictoporella exigua Ulrich.

1893. Stictoporella exigua. Ulrich, Geol. Minnesota, III, pl. xiii, 18-21.
Trenton: Montreal, Canada.

Stictoporella flabellata (Hall).

1851. Clathropora flabellata. Hall, Foster and Whitney's Rep. Geol. Lake Superior Land District, Part II, p. 207, pl. xxiv, 2*a*, *b*.
Trenton: Escanaba River, below Indian Creek, Upper Peninsula, Michigan.

Stictoporella flexuosa (James).

1878. Ptilodictya flexuosa. James, Paleontologist, No. 1, p. 4.
1882. Stictoporella flexuosa. Ulrich, Jour. Cincinnati Soc. Nat. Hist., V, p. 169.
1882. Stictoporella interstincta. Ulrich, Jour. Cincinnati Soc. Nat. Hist., V, p. 169, pl. viii, 9, 9*a*.
1889. Stictoporella interstincta. Miller, North American Geol. Pal., figs. 520, 521 (p. 325).
1890. Stictoporella interstincta. Ulrich, Geol. Surv. Illinois, VIII, fig. 14*a*, *b* (p. 394).

Cincinnati (Utica): Cincinnati, Ohio, and vicinity.

Stictoporella frondifera Ulrich.

1886. Stictoporella frondifera. Ulrich, Fourteenth Ann. Rep. Geol. Nat. Hist. Surv. Minnesota, p. 72.
1893. Stictoporella frondifera. Ulrich, Geol. Minnesota, III, p. 183, pl. xi, 12–19.

Trenton (Stones River): Minneapolis, Minnesota.

Stictoporella interstincta Ulrich. See Stictoporella flexuosa (James).

Stictoporella rigida Ulrich.

1890. Stictoporella rigida. Ulrich, Jour. Cincinnati Soc. Nat. Hist., XII, p. 188, fig. 13.
1893. Stictoporella rigida. Ulrich, Geol. Minnesota, III, p. 180, pl. xi, 20, 21.

Trenton (Black River): Fountain, St. Paul, and Cannon Falls, Minnesota.

Stictoporella ? undulata Ulrich. See Intrapora undulata (Ulrich).

Stictoporidra Simpson. See Tæniopora Nicholson.

Stictoporina Simpson (in part). See Tæniopora Nicholson.

STICTOPORINA Hall and Simpson. Genotype: Trematopora claviformis Hall.

1887. Stictoporina. Hall and Simpson, Pal. New York, VI, p. xx.
1889. Stictoporina. Miller, North American Geol. Pal., p. 325.
1897. Stictoporina. Simpson, Fourteenth Ann. Rep. State Geologist New York for the year 1894, p. 543 (not p. 532, which is probably in error for Stictoporidra).

Stictoporina claviformis (Hall).

1883. Trematopora claviformis. Hall, Trans. Albany Institute, X, p. 181 (abstract 1881, p. 181).
1884. Trematopora claviformis. Hall, Rep. State Geologist New York for the year 1883, p. 12.
1887. Stictopora (Stictoporina) claviformis. Hall and Simpson, Pal. New York, VI, p. 269.
1897. Stictoporina claviformis. Simpson, Fourteenth Ann. Rep. State Geologist New York for the year 1894, pl. x, 1, 2.

Hamilton: Bellona, New York.

Stictoporina plumea (Hall and Simpson).

1887. Ptilodictya plumea. Hall and Simpson, Pal. New York, VI, p. 271, pl. lxi, 9–12.
1891. Ptilodictya plumea. Hall, Tenth Ann. Rep. State Geologist New York for the year 1890, p. 55; Forty-fourth Ann. Rep. New York State Mus., p. 85.
1897. Ptilodictya plumea. Simpson, Fourteenth Ann. Rep. State Geologist New York for the year 1894, pl. xv, 4–6.
1899. Ptilodictya plumea. Grabau, Bull. Buffalo Soc. Nat. Sci., VI, p. 176, fig. 73.

Stictoporina plumea (Hall and Simpson)—Continued.

1887. Ptilodictya retiformis. Hall and Simpson, Pal. New York, VI, p. 272, pl. lxi, 13.
1897. Ptilodictya retiformis. Simpson, Fourteenth Ann. Rep. State Geologist New York for the year 1894, pl. xv, 7.
Hamilton: Hamburg, New York.
Obs. See also note under Stictoporina scutulata (Hall).

Stictoporina scutulata (Hall).

1883. Stictopora ? scutulata. Hall, Trans. Albany Institute, X, p. 191 (abstract, 1881, p. 191).
1884. Stictopora ? scutulata. Hall, Rep. State Geologist New York for the year 1883, p. 47.
1887. Ptilodictya scutulata. Hall and Simpson, Pal. New York, VI, p. 272.
Hamilton: Canandaigua Lake, New York.
Obs. Probably a synonym for Stictoporina plumea (Hall and Simpson).

Stictoporina subcarinata Simpson. See Tæniopora subcarinata (Hall).

STICTOTRYPA Ulrich. Genotype: Stictopora similis Hall.

1890. Stictotrypa. Ulrich, Geol. Surv. Illinois, VIII, p. 393.
1896. Stictotrypa. Ulrich, Zittel's Textb. Pal. (Engl. ed.), p. 279.

Stictotrypa orbipora (Hall).

1883. Stictopora orbipora. Hall, Trans. Albany Institute, X, p. 61 (abstract, 1879, p. 5).
1882. Stictopora orbipora. Hall, Eleventh Ann. Rep. Indiana Geol. Nat. Hist., p. 248.
Niagara: Waldron, Indiana

Stictotrypa punctipora (Hall).

1852. Stictopora punctipora. Hall, Pal. New York, II, p. 157, pl. xl B, 2*a*–*c*.
1889. Stictopora punctipora. Miller, North American Geol. Pal., fig. 519 (p. 324).
1890. Stictotrypa punctipora. Ulrich, Geol. Surv. Illinois, VIII, fig. 13*a* (p. 394).
Niagara: Lockport, New York.

Stictotrypa similis (Hall).

1876. Stictopora similis. Hall, Twenty-eighth Ann. Rep. New York State Mus. (documentary edition), pl. xi, 13–16; ibid. (Museum edition, 1879), p. 122, pl. xi, 13–16.
1882. Stictopora similis. Hall, Eleventh Ann. Rep. Indiana Geol. Nat. Hist., p. 247, pl. x, 13–16.
1890. Stictotrypa similis. Ulrich, Geol. Surv. Illinois, VIII, fig. 13*b*, *c* (p. 394).
1889. Stictopora ovatipora (not of Hall). Miller, North American Geol. Pal., fig. 518 (p. 324).
Niagara: Waldron, Indiana.
Clinton: Belfast, Ohio (Foerste).

STOMATOPORA Bronn. Genotype: Alecto dichotoma Lamouroux.

Alecto, Lamouroux, 1821, Blainville, Johnston, Milne-Edwards, Busk, and others. (Not Alecto, Leach, 1814, a genus of Echinodermata.)
Aulopora (in part). Goldfuss, Reuss, Hall, Nicholson.
1825. Stomatopora. Bronn, Pflanzenth., p. 27.
1854. Stomatopora. D'Orbigny, Pal. Francais, Terr. Cret., V, p. 833.
1854. Stomatopora. Haime, Bry. Foss. Form. Juras., p. 159. [Extra ed., p. 3.]
1880. Stomatopora (in part). Hincks, British Marine Polyzoa, p. 424.
1882. Stomatopora. Ulrich, Jour. Cincinnati Soc. Nat. Hist., V, p. 149.
1889. Stomatopora. Miller, North American Geol. Pal., p. 325.

STOMATOPORA Bronn—Continued.
1890. Stomatopora. Ulrich, Geol. Surv. Illinois, VIII, p. 367.
1893. Stomatopora. Ulrich, Geol. Minnesota, III, p. 115.
1896. Stomatopora. Ulrich, Zittel's Textb. Pal., (Eng. ed.), p. 260.
1897. Stomatopora. Simpson, Fourteenth Ann. Rep. State Geologist New York for the year 1894, p. 597.

Stomatopora ? alternata Hall and Whitfield. See Hederella alternata (Hall and Whitfield).

Stomatopora arachnoidea (Hall).
1847. Aulopora arachnoidea. Hall, Pal. New York, I, p. 76, pl. xxvi, 6*a–c*, and woodcut on p. 76.
1875. Aulopora arachnoidea. Nicholson, Pal. Ohio, II, p. 216, pl. xxiii, 1, 1*b*.
Trenton and Cincinnati (Utica, Lorraine, and Richmond): Various localities in New York, Ohio, Indiana, and Kentucky.

Stomatopora auloporoides Miller. See Proboscina auloporoides (Nicholson).

Stomatopora canadensis Whiteaves.
1897. Stomatopora Canadensis. Whiteaves, Pal. Foss., III, p. 161, pl. xviii, 4, 4*a*.
Trenton: Little Black Island, Lake Winnipeg, Canada.

Stomatopora confusa Miller. See Proboscina confusa (Nicholson).

Stomatopora delicatula (James).
1878. Hippothoa delicatula. James, Paleontologist, No. 1, p. 6.
1882. Stomatopora proutana. Miller, Jour. Cincinnati Soc. Nat. Hist., V, p. 39, pl. i, 4–4*b*.
1890. Stomatopora proutana. Ulrich, Jour. Cincinnati Soc. Nat. Hist., XII, fig. 2*c* (p. 175).
1893. Stomatopora proutana. Ulrich, Geol. Minnesota, III, p. 117, pl. i, 8–12.
1886. Rhopalonaria pertenuis. Ulrich, Fourteenth Ann. Rep. Geol. Nat. Hist. Sur. Minnesota, p. 59.
Trenton (Stones River, Black River, and Trenton) and Cincinnati (Utica, Lorraine, and Richmond): Various localities in Ohio, Indiana, Kentucky, Tennessee, Illinois, Iowa, and Minnesota.

Stomatopora delicatula-tenuissima Ulrich.
1890. Stomatopora tenuissima. Ulrich, Jour. Cincinnati Soc. Nat. Hist., XII, p. 175, fig. 2.
1893. Stomatopora tenuissima. Ulrich, Geol. Minnesota, III, p. 116, pl. i, 6, 7.
1896. Stomatopora tenuissima. Ulrich, Zittel's Textb. Pal. (Eng. ed.), fig. 412A (p. 261).
Cincinnati (Utica): Cincinnati, Ohio, and vicinity.

Stomatopora frondosa Miller. See Proboscina frondosa (Nicholson).

Stomatopora (Proboscina) frondosa Ulrich. See Proboscina frondosa (Nicholson).

Stomatopora inflata (Hall).
1847. Alecto inflata. Hall, Pal. New York, I, p. 77, pl. xxvi, 7*a*, *b*.
1875. Hippothoa inflata. Nicholson, Pal. Ohio, II, p. 268, pl. xxv, 1–1*b*.
1881. Stomatopora inflata. Vine, Quar. Jour. Geol. Soc. London, XXXVII, p. 615.
1890. Stomatopora inflata. Ulrich, Jour. Cincinnati Soc. Nat. Hist., XII, p. 176, fig. 3*c*.

Stomatopora inflata (Hall)—Continued.

1893. Stomatopora inflata. Ulrich, Geol. Minnesota, III, p. 117, pl. i, 13–21.

1896. Stomatopora inflata. Ulrich, Zittel's Textb. Pal. (Eng. ed.), fig. 412B (p. 261).

1897. Stomatopora inflata. Simpson, Fourteenth Ann. Rep. State Geologist New York for the year 1894, figs. 202–204 (p. 597).

Trenton and Cincinnati: At various localities in the Black River of Minnesota; in the Trenton of New York, Kentucky, Minnesota, and Canada; in the Lorraine of Ohio, and in the Richmond of Ohio, Indiana, Kentucky, and Illinois.

Stomatopora ?? moniliformis Whiteaves.

1891. Stomatopora moniliformis. Whiteaves, Contr. Canadian Pal., I, p. 212, pl. xxviii, 10.

Devonian (Hamilton ?): Hay River, Canada.

Stomatopora parva Ringueberg.

1886. Stomatopora parva. Ringueberg, Bull. Buffalo Soc. Nat. Hist., V, p. 20, pl. ii, 16.

Niagara: Lockport, New York.

Stomatopora proutana Miller. See Stomatopora delicatula (James).

Stomatopora recta Ringueberg.

1886. Stomatopora recta. Ringueberg, Bull. Buffalo Soc. Nat. Sci., V, p. 20, pl. ii, 15, 15*a*.

Niagara: Lockport, New York.

Stomatopora tenuissima Ulrich. See Stomatopora delicatula-tenuissima Ulrich.

Stomatopora turgida Ulrich.

1890. Stomatopora turgida. Ulrich, Jour. Cincinnati Soc. Nat. Hist., XII, p. 176, fig. 3.

1893. Stomatopora turgida. Ulrich, Geol. Minnesota, III, p. 118, pl. i, 22, 23.

Cincinnati (Richmond): Wilmington, Illinois.

STREBLOTRYPA Ulrich. Genotype: Streblotrypa nicklesi Ulrich.

1890. Streblotrypa. Ulrich, Geol. Surv. Illinois, VIII, pp. 403, 665.

1889. Streblotrypa. (Ulrich, in press), Miller, North American Geol. Pal., p. 325.

1897. Streblotrypa. Simpson, Fourteenth Ann. Rep. State Geologist New York for the year 1894, p. 551.

1899. Streblotrypa. Grabau, Bull. Buffalo Soc. Nat. Sci., VI, p. 167.

1887. Acanthoclema (in part). Hall and Simpson, Pal. New York, VI, p. xv.

Streblotrypa amplexa Ulrich.

1888. Streblotrypa amplexa. Ulrich, Bull. Denison Univ., IV, p. 86, pl. xiv, 13.

Waverly: Sciotoville, Ohio.

Streblotrypa (? Lioclema) denticulata Ulrich.

1888. Streblotrypa (? Lioclema) denticulata. Ulrich, Bull. Denison Univ., IV, p. 88, pl. xiv, 18, 19.

Waverly: Richfield and Lodi, Ohio.

Streblotrypa distincta Ulrich.

1890. Streblotrypa distincta. Ulrich, Geol. Surv. Illinois, VIII, p. 669, pl. lxxi, 10–10*b*.

1894. Streblotrypa distincta. Keyes, Missouri Geol. Sur., V, p. 36.

Chester: Chester, Illinois.

Streblotrypa hamiltonensis (Nicholson).

1874. Ceriopora ? Hamiltonensis. Nicholson, Geol. Mag., new ser., I, p. 161, pl. ix, 17.
1874. Ceriopora ? Hamiltonensis. Nicholson, Pal. Ontario, p. 97, fig. 33.
1883. Callopora Hamiltonensis. Hall, Trans. Albany Institute, X, p. 182 (abstract, 1881, p. 182).
1887. Acanthoclema Hamiltonense. Hall and Simpson, Pal. New York, VI, p. 191, pl. lv, 18–26.
1889. Streblotrypa hamiltonensis. Miller, North American Geol. Pal., p. 326.
1889. Rhombopora Hamiltonensis. Nicholson and Lyddeker, Manual Paleontology, I, fig. 455 B (p. 610), fig. 478 (p. 632).
1890. Streblotrypa hamiltonensis. Ulrich, Geol. Surv. Illinois, VIII, p. 648.
1897. Streblotrypa Hamiltonense. Simpson, Fourteenth Ann. Rep. State Geologist New York for the year 1894, p. xix, 14, 15.
1898. Streblotrypa Hamiltonensis. Whiteaves, Contr. Canadian Pal., I, Part V, p. 378.
1899. Streblotrypa hamiltonense. Grabau, Bull. Buffalo Soc. Nat. Sci., VI, p. 167, fig. 59.
1884. Callopora bipunctata. Hall, Rep. State Geologist New York for the year 1883, p. 15.
Hamilton: Arkona and Widder, Ontario; Hamburg and New Berlin, New York.

Streblotrypa hertzeri Ulrich.

1888. Streblotrypa hertzeri. Ulrich, Bull. Denison Univ., IV, p. 85, pl. xiv, 8.
Waverly: Richfield and Lodi, Ohio.
Keokuk: Keokuk, Iowa.

Streblotrypa major Ulrich.

1888. Streblotrypa major. Ulrich, Bull. Denison Univ., IV, p. 84, pl. xiv, 10.
1890. Streblotrypa major. Ulrich, Geol. Surv. Illinois, VIII, p. 666, pl. lxxi, 8–8*d*, pl. lxxii, 1, 1*a*.
1894. Streblotrypa major. Keyes, Missouri Geol. Surv., V, p. 35.
Waverly: Richfield, Ohio.
Keokuk: Kings Mountain, Kentucky; Keokuk, Iowa; Nauvoo, Illinois.

Streblotrypa multiporata Ulrich.

1888. Streblotrypa multiporata. Ulrich, Bull. Denison Univ., IV, p. 87, pl. xiv, 11.
Waverly: Moots Run, Ohio.

Streblotrypa nicklesi Ulrich.

1884. Streblotrypa nicklesi. Ulrich (Mss.).
1884. Streblotrypa Nicklesi. Vine, Proc. Yorkshire Geol. Polyt. Soc., VIII, p. 107, pl. xxi, 4, 5.
1885. Streblotrypa Nicklesi. Vine, Proc. Yorkshire Geol. Polyt. Soc., IX, p. 96.
1890. Streblotrypa nicklesi. Ulrich, Geol. Surv. Illinois, VIII, p. 667, pl. lxxi, 9–9*c*.
1894. Streblotrypa nicklesi. Keyes, Missouri Geol. Surv., V, p. 36.
Chester: Kaskaskia, Chester, Red Bud, Anna, and other localities, Illinois; Sloans Valley, Kentucky.
Carboniferous: England (Vine).
Obs. See also Streblotrypa prisca (Gabb and Horn).

Streblotrypa obliqua Ulrich.

1888. Streblotrypa obliqua. Ulrich, Bull. Denison Univ., IV, p. 85, pl. xiv, 9.
Waverly: Lodi, Ohio.

Streblotrypa prisca (Gabb and Horn).

1862. Cavea prisca. Gabb and Horn, Jour. Acad. Nat. Sci. Philadelphia, ser. 2, V, p. 175, pl. xxi, 67.
Carboniferous: Fort Belknap, Texas.
Obs. This species resembles Streblotrypa nicklesi Ulrich, but has much larger cells.

Streblotrypa radialis Ulrich.

1890. Streblotrypa radialis. Ulrich, Geol. Surv. Illinois, VIII, p. 667, pl. lxxii, 2–2*c*.
1894. Streblotrypa radialis. Keyes, Missouri Geol. Surv., V, p. 35.
Keokuk: Near Nauvoo, Illinois; Bentonsport, Iowa.

Streblotrypa regularis Ulrich.

1888. Streblotrypa regularis. Ulrich, Bull. Denison Univ., IV, p. 88, pl. xiv, 14.
Waverly: Burbank and Cuyahoga County, Ohio.

Streblotrypa scutulata (Hall).

1883. Trematopora scutulata. Hall, Trans. Albany Institute, X, p. 180 (abstract, 1881, p. 180).
1884. Trematopora scutulata. Hall, Rep. State Geologist New York for the yea 1883, p. 7.
1887. Acanthoclema scutulatum. Hall and Simpson, Pal. New York, VI, p. 190, pl. lv, 15, 16, ? 17; pl. lvi, 19, ? 20.
1890. Streblotrypa scutulata. Ulrich, Geol. Surv. Illinois, VIII, p. 648.
1899. Acanthoclema scutulatum. Grabau, Bull. Buffalo Soc. Nat. Sci., VI, p. 166, fig. 58.
Hamilton: York and Hamburg, New York.

Streblotrypa striata Ulrich.

1888. Streblotrypa striata. Ulrich, Bull. Denison Univ., IV, p. 87, pl. xiv, 12, 12*a*.
Waverly: Richfield and Cuyahoga County, Ohio.

Streblotrypa subspinosa Ulrich.

1890. Streblotrypa subspinosa. Ulrich, Geol. Surv. Illinois, VIII, p. 668, pl. lxxi, 7, 7*a*.
Chester: Chester, Illinois; Sloans Valley, Kentucky.

Stromatopora lichenoides James. See **Arthropora shafferi** (Meek).

STROMATOTRYPA Ulrich. Genotype: **Stromatotrypa ovata** Ulrich.

1893. Stromatotrypa. Ulrich, Geol. Minnesota, III, p. 301.

Stromatotrypa ovata Ulrich.

1893. Stromatotrypa ovata. Ulrich, Geol. Minnesota, III, p. 302, pl. xxiv, 24–31.
Trenton (Stones River and Black River): Minneapolis and St. Paul, Minnesota; Beloit, Wisconsin.

STROTOPORA Ulrich. Genotype: **Strotopora foveolata** Ulrich.

1890. Strotopora. Ulrich, Geol. Surv. Illinois, VIII, pp. 383, 486.
1889. Strotopora. (Ulrich, in press), Miller, North American Geol. Pal., p. 326.
1896. Strotopora. Ulrich, Zittel's Textb. Pal. (Engl. ed.), p. 270.
1897. Strotopora. Simpson, Fourteenth Ann. Rep. State Geologist New York for the year 1894, p. 560.

Strotopora dermata Ulrich.

1890. Strotopora dermata. Ulrich, Geol. Surv. Illinois, VIII, p. 488, pl. lxxvii, 8, 8*a*.
1894. Strotopora dermata. Keyes, Missouri Geol. Surv., V, p. 17.

Strotopora dermata Ulrich—Continued.

1897. Strotopora dermata. Simpson, Fourteenth Ann. Rep. State Geologist New York for the year 1894, fig. 127 (p. 560).

Keokuk: Keokuk, Iowa; Warsaw, Illinois.

Strotopora foveolata Ulrich.

1890. Strotopora foveolata. Ulrich, Geol. Surv. Illinois, VIII, p. 487, pl. lxxvii, 9, *9a*.

1894. Strotopora foveolata. Keyes, Missouri Geol. Surv., V, p. 17.

1896. Strotopora foveolata. Ulrich, Zittel's Textb. Pal. (Engl. ed.), fig. 445 (p. 270).

1897. Strotopora foveolata. Simpson, Fourteenth Ann. Rep. State Geologist New York for the year 1894, fig. 126 (p. 560).

Keokuk: Bentonsport, Iowa; Warsaw, Illinois.

Strotopora perminuta Ulrich.

1890. Strotopora perminuta. Ulrich, Geol. Surv. Illinois, VIII, p. 487, pl. xlvii, 4–*4b*.

Hamilton: Falls of the Ohio.

Subretepora D'Orbigny. Not recognized (see Geol. Surv. Illinois, VIII, p. 687).

1850. Subretepora. D'Orbigny, Prodr. de Pal., I, p. 22.

Subretepora angulata Miller. See Phylloporina angulata (Hall).

Subretepora aspera Miller. See Phylloporina aspera (Hall).

Subretepora asperato-striata Miller. See Phylloporina asperato-striata (Hall).

Subretepora clathrata Miller. See Phylloporina clathrata (Miller and Dyer).

Subretepora corticosa Miller. See Phylloporina corticosa (Ulrich).

Subretepora dawsoni Miller. See Phylloporina dawsoni Ulrich.

Subretepora dichotoma Miller. See Thamniscus dichotomus (Hall).

Subretepora fenestrata Miller. See Phylloporina fenestrata (Hall).

Subretepora gracilis Miller. See Phylloporina gracilis (Hall).

Subretepora incepta Miller. See Phylloporina incepta (Hall).

Subretepora reticulata Miller. See Phylloporina reticulata (Hall).

Subretepora trentonensis Miller. See Phylloporina trentonensis (Nicholson).

Subretepora variolata Miller. See Phylloporina variolata (Ulrich).

Sulcopora D'Orbigny. Not recognized (see Geol. Surv. Illinois, VIII, p. 687).

1850. Sulcopora. D'Orbigny, Prodr. de Pal., I, p. 22.

Sulcopora fenestrata D'Orbigny. See Rhinidictya fenestrata (Hall).

SYNOCLADIA King. Genotype: Retepora virgulacea Phillips.

1849. Synocladia. King, Ann. Mag. Nat. Hist., ser. 2, II, p. 388.

1850. Synocladia. King, Mon. Permian Foss., p. 38.

1854. Synocladia. McCoy, Brit. Pal. Foss., p. 114.

1875. Synocladia. Etheridge, Jun., Proc. Geol. Assoc., IV, p. 116.

1885. Synocladia. Hall, Rep. State Geologist New York for the year 1884, p. 37.

1885. Synocladia. Waagen and Pichl, Pal. Indica, Ser., XIII, pp. 774, 801.

1886. Synocladia. Ulrich, Contr. American Pal., I, p. 6.

SYNOCLADIA King—Continued.

1889. Synocladia. Miller, North American Geol. Pal., p. 326.
1890. Synocladia. Ulrich, Geol. Surv. Illinois, VIII, p. 398.
1895. Synocladia. Simpson, Thirteenth Ann. Rep. State Geologist New York for the year 1893, pp. 720, 726; Forty-seventh Ann. Rep. New York State Mus., pp. 914, 920.
1896. Synocladia. Ulrich, Zittel's Textb. Pal. (Eng. ed.), p. 283.
1897. Synocladia. Simpson, Fourteenth Ann. Rep. State Geologist New York for the year 1894, pp. 513, 521.

Synocladia biserialis Swallow. See Septopora biserialis (Swallow).

Synocladia biserialis var. gracilis Meek. See Septopora biserialis-gracilis Meek.

Synocladia rectistyla Whitfield. See Septopora rectistyla (Whitfield).

Synocladia virgulacea Swallow (not Phillips, nor King). See Septopora biserialis (Swallow).

Obs. See also Simpson, Fourteenth Ann. Rep. State Geologist New York for the year 1894, pp. 513, 514.

Tabulipora Young. See Stenopora Lonsdale.

TÆNIODICTYA Ulrich. Genotype: Tæniodictya ramulosa Ulrich.

1890. Tæniodictya. Ulrich, Geol. Surv. Illinois, VIII, p. 393.
1889. Tæniodictya. (Ulrich, in press), Miller, North American Geol. Pal., p. 327.
1897. Tæniodictya. Simpson, Fourteenth Ann. Rep. State Geologist New York for the year 1894, p. 533.

Tæniodictya cingulata Ulrich.

1890. Tæniodictya cingulata. Ulrich, Geol. Surv. Illinois, VIII, p. 530, pl. lxvii, 3–3*b*, fig. 2*b* (p. 304).
Keokuk: Warsaw, Illinois.

Tæniodictya frondosa Ulrich.

1890. Tæniodictya frondosa. Ulrich, Geol. Surv. Illinois, VIII, p. 259, pl. lxvii, 5, pl. lxix, 5–5*c*.
1894. Tæniodictya frondosa. Keyes, Missouri Geol. Surv., V, p. 22.
Keokuk: Keokuk, Iowa; Nauvoo, Illinois.

Tæniodictya interpolata Ulrich.

1888. Tæniodictya interpolata. Ulrich, Bull. Denison Univ., IV, p. 80, pl. xiii, 9, 9*a*.
Waverly: Richfield and Cuyahoga County, Ohio.

Tæniodictya ramulosa Ulrich.

1890. Tæniodictya ramulosa. Ulrich, Geol. Surv. Illinois, VIII, p. 528, pl. lxvii, 1–1*l*.
1894. Tæniodictya ramulosa. Keyes, Missouri Geol. Surv., V, p. 22.
1897. Tæniodictya ramulosa. Simpson, Fourteenth Ann. Rep. State Geologist New York for the year 1894, figs. 89, 90 (p. 533).
Keokuk: Keokuk, Iowa; Nauvoo and Warsaw, Illinois.

Tæniodictya ramulosa-burlingtonensis Ulrich.

1890. Tæniodictya ramulosa var. burlingtonensis. Ulrich, Geol. Surv. Illinois, VIII, p. 529, pl. lxvii, 2–2*b*.
Burlington: Burlington, Iowa.

Tæniodictya ? rhomboidea (Hall).

1883. Stictopora rhomboidea. Hall, Trans. Albany Institute, X, p. 157 (abstract, 1881, p. 15).
1886. Stictopora rhomboidea. Hall, Fifth Ann. Rep. State Geologist New York for the year 1885, pl. xxix, 27, 28.
1887. Stictopora rhomboidea. Hall and Simpson, Pal. New York, VI, p. 95, pl. xxix, 27, 28.
Upper Helderberg: West of Le Roy, New York.

Tæniodictya subrecta Ulrich.

1890. Tæniodictya subrecta. Ulrich, Geol. Surv. Illinois, VIII, p. 530, pl. lxvii, 4–4*d*.
St. Louis: Elizabethtown, Kentucky.

TÆNIOPORA Nicholson. Genotype: Tæniopora exigua Nicholson.

1874. Tæniopora. Nicholson, Canadian Jour., new ser., XIV, p. 133.
1874. Tæniopora. Nicholson, Geol. Mag., new ser., I, p. 121.
1874. Tæniopora. Nicholson, Pal. Province Ontario, p. 107.
1883. Tæniopora. Hall, Trans. Albany Institute, X, p. 192 (abstract, 1881, p. 192).
1884. Tæniopora. Hall, Rep. State Geologist New York for the year 1883, p. 49.
1887. Tæniopora. Hall and Simpson, Pal. New York, VI, p. xxi.
1889. Tæniopora. Miller, North American Geol. Pal., p. 327.
1890. Tæniopora. Ulrich, Geol. Surv. Illinois, VIII, p. 386.
1896. Tæniopora. Ulrich, Zittel's Textb. Pal. (Eng. ed.), p. 280.
1897. Tæniopora. Simpson, Fourteenth Ann. Rep. State Geologist New York for the year 1894, p. 533.
1899. Tæniopora. Grabau, Bull. Buffalo Soc. Nat. Sci., VI, p. 174.
1883. Pteropora. Hall, Trans. Albany Institute, X, p. 192 (abstract, 1881, p. 192).
1897. Stictoporidra. Simpson, Fourteenth Ann. Rep. State Geologist New York for the year 1894, p. 527.
1897. Stictoporina (in error for Stictoporidra). Simpson, Fourteenth Ann. Rep. State Geologist New York for the year 1894, p. 532 (not p. 543).

Tæniopora exigua Nicholson.

1874. Tæniopora exigua. Nicholson, Geol. Mag., new ser., I, p. 122, pl. vi, 13.
1874. Tæniopora exigua. Nicholson, Pal. Province Ontario, p. 108, fig. 47.
1883. Tæniopora exigua. Hall, Trans. Albany Institute, X, p. 192 (abstract, 1881, p. 192).
1884. Tæniopora exigua. Hall, Rep. State Geologist New York for the year 1883, p. 49.
1887. Tæniopora exigua. Hall and Simpson, Pal. New York, VI, p. 263, pl. lxii, 15–26.
1897. Tæniopora exigua. Simpson, Fourteenth Ann. Rep. State Geologist New York for the year 1894, pl. xi, 12–16, pl. xii, 1–5.
1899. Tæniopora exigua. Grabau, Bull. Buffalo Soc. Nat. Sci., VI, p. 174, fig. 71.
1883. Pteropora duogeneris. Hall, Trans. Albany Institute, X, p. 192 (abstract, 1881, p. 192).
Hamilton: Arkona, Ontario; Bellona, West Hamburg, and other localities in New York.

Tæniopora occidentalis Ulrich.

1890. Tæniopora occidentalis. Ulrich, Geol. Sur. Illinois, VIII, p. 505, pl. xlii, 3–3*c*.
Hamilton: Buffalo, Iowa.

Tæniopora penniformis Nicholson.

1874. Tæniopora penniformis. Nicholson, Geol. Mag., new ser., I, p. 123, pl. vi, 12.
1874. Tæniopora penniformis. Nicholson, Pal. Province Ontario, p. 109, fig. 46.
1890. Tæniopora penniformis. Ulrich, Geol. Sur. Illinois, VIII, p. 505, pl. xlii, 3*d*.
Hamilton: Arkona, Ontario; Eighteenmile Creek, New York.

Tæniopora recubans (Hall and Simpson).

1887. Stictopora recubans. Hall and Simpson, Pal. New York, VI, p. 260, pl. lxiii, 20, 21.
1891. Stictopora recubans. Hall, Tenth Ann. Rep. State Geologist New York for the year 1890, p. 51; Forty-fourth Ann. Rep. New York State Mus., p. 81.
Hamilton: Seneca Lake, New York.
Obs. This may be identical with Tæniopora subcarinata (Hall).

Tæniopora subcarinata (Hall).

1883. Stictopora ? subcarinata. Hall, Trans. Albany Institute, X, p. 191 (abstract, 1881, p. 191).
1887. Stictopora subcarinata. Hall and Simpson, Pal. New York, VI, p. 261, pl. lxiii, 1–6.
1891. Stictopora subcarinata. Hall, Tenth Ann. Rep. State Geologist New York for the year 1890, p. 52; Forty-fourth Ann. Rep. New York State Mus., p. 82
1897. Stictoporina subcarinata. Simpson, Fourteenth Ann. Rep. State Geologist New York for the year 1894, pl. x, 8, pl. xii, 6.
1884. Stictopora? dichotoma. Hall, Rep. State Geologist New York for the year 1883, p. 48.
Hamilton: Bellona, Alden Station, and York, New York.
Obs. See note under Tæniopora recubans (Hall).

Tectulipora Hall. See Loculipora Hall.
Tectulipora biperforata Simpson. See Loculipora loculata (Hall).
Tectulipora loculata Simpson. See Loculipora loculata (Hall).
Tectuliporella Simpson. See Isotrypa Hall.
Tectuliporella consimilis Simpson. See Isotrypa consimilis Hall.

THALLOSTIGMA Hall. Genotype: Thallostigma intercellata Hall.

1883. Thallostigma. Hall, Trans. Albany Institute, X, p. 154 (abstract, 1881, p. 12).
Obs.—This name seems to have been regarded by its author in his later work as a synonym of Fistulipora. The original definition is of little value, but a study of the genotype is likely to show that the name may be held for a group of species now included under Lioclema, of which Lioclema minutum (Rominger) is a typical example. Having no authentic specimens of the genotype, we have not made these changes, but have left this species and the closely allied, if not identical, Hamilton group forms under Lioclema.

Thallostigma confertipora Hall. See Lioclema confertiporum (Hall).
Thallostigma decipiens Hall. See Lioclema decipiens (Hall).
Thallostigma densa Hall. See Lioclema densum (Hall).
Thallostigma digitata Hall. See Lioclema digitatum (Hall).
Thallostigma inclusa Hall. See Favicella inclusa (Hall).
Thallostigma inclusapora Hall. See Favicella inclusa (Hall).
Thallostigma intercellata Hall. See Lioclema intercellatum (Hall).

Thallostigma lamellata Hall. See Fistulipora ? lamellata (Hall).
Thallostigma longimacula Hall. See Fistulipora ? longimacula (Hall).
Thallostigma micropora Hall. See Lioclema microporum (Hall).
Thallostigma multaculeata Hall. See Lioclema multaculeatum (Hall).
Thallostigma plana Hall. See Pinacotrypa plana (Hall).
Thallostigma scrobiculata Hall. See Fistulipora ? scrobiculata (Hall).
Thallostigma segregata Hall. See Lioclema segregatum (Hall).
Thallostigma serrulata Hall. See Pinacotrypa serrulata (Hall).
Thallostigma sparsipora Hall. See Prismopora sparsipora (Hall).
Thallostigma spheroidea Hall. See Lioclema ? spheroideum (Hall).
Thallostigma striata Hall. See Lioclema minutum (Rominger).
Thallostigma subtilis Hall. See Lioclema subtile (Hall).
Thallostigma triangularis Hall. See Fistulipora ? triangularis (Hall).
Thallostigma umbilicata Hall. See Fistulipora ? umbilicata (Hall).
Thallostigma variapora Hall. See Pinacotrypa variapora (Hall).

Thamnicella ascuta Simpson.

1897. **Thamnicella ascuta** Hall. Simpson, Fourteenth Ann. Rep. State Geologist New York for the year 1894, pl. ix, 6–8.

Obs. Simpson ascribes this species to Hall, but we are unable to find it in any of the latter's works.

Thamnicella Cisseis Simpson. See Drymotrypa cisseis (Hall).
Thamnicella Nysa Simpson. See Thamniscus nysa Hall.

THAMNISCUS King. Genotype: Ceratophytes dubius Schlotheim.

1849. Thamniscus. King, Ann. Mag. Nat. Hist., ser. 2, II, p. 389.
1850. Thamniscus. King, Perm. Foss. England, p. 44.
1860. Thamniscus. Eichwald, Lethæa Rossica, I, p. 386.
1875. Thamniscus. Etheridge, Jun., Proc. Geol. Assoc., IV, p. 120.
1882. Thamniscus. Shrubsole, Quar. Jour. Geol. Soc. London, XXXVIII, p. 343.
1885. Thamniscus. Vine, Proc. Yorkshire Geol. Polyt. Soc., IX, p. 89.
1885. Thamniscus. Waagen and Pichl, Pal. Indica, Ser. XIII, p. 807.
1886. Thamniscus. Ulrich, Contr. American Pal., I, p. 5.
1887. Thamniscus. Hall and Simpson, Pal. New York, VI, p. xxii.
1889. Thamniscus. Miller, North American Geol. Pal., p. 327.
1890. Thamniscus. Ulrich, Geol. Sur. Illinois, VIII, pp. 397, 606.
1896. Thamniscus. Ulrich, Zittel's Textb. Pal. (Eng. ed.), p. 283.
1897. Thamniscus. Simpson, Fourteenth Ann. Rep. State Geologist New York for the year 1894, p. 524.

Thamniscus ? Cisseis Hall. See Drymotrypa cisseis (Hall).

Thamniscus dichotomus (Hall).

1852. Hornera ? dichotoma. Hall, Pal. New York, II, p. 163, pl. xlC, 3*a*–*d*.
1889. Subretepora dichotoma. Miller, North American Geol. Pal., p. 326.
1890. Thamniscus dichotoma. Ulrich, Geol. Sur. Illinois, VIII, p. 607.

Niagara: Lockport and Rochester, New York.

Thamniscus divaricans Ulrich.

1890. **Thamniscus** divaricans. Ulrich, Geol. Sur. Illinois, VIII, p. 608, pl. lxii, 6–6*c*.

Keokuk: Kings Mountain, Kentucky.

Thamniscus fruticellus Hall.

1879. Thamniscus fruticella. Hall, Thirty-second Ann. Rep. New York State Museum, p. 176 (reprint, 1880, p. 37).

1883. Thamniscus fruticella. Hall, Rep. State Geologist New York for the year 1882, pl. xxii, 33.

1887. Thamniscus fruticella. Hall and Simpson, Pal. New York, VI, p. 42, pl. xxii, 33.

Lower Helderberg: Clarksville, New York.

Thamniscus furcillatus Ulrich.

1890. Thamniscus furcillatus. Ulrich, Geol. Sur. Illinois, VIII, p. 609, pl. lxii, 9–9*b*.

1894. Thamniscus furcillatus. Keyes, Missouri Geol. Sur., V, p. 31, pl. xxxiii, 6.

Chester: Chester, Kaskaskia, Red Bud, and other localities in Illinois; Sloans Valley and Litchfield, Kentucky.

Thamniscus multiramus Hall.

1883. Thamniscus multiramus. Hall, Trans. Albany Institute, X, p. 161 (abstract, 1881, p. 19).

1883. Thamniscus multiramus. Hall, Rep. State Geologist New York for the year 1882, pl. xxvi, 1–5.

1887. Thamniscus multiramus. Hall and Simpson, Pal. New York, VI, p. 104, pl. xxxiii, 1–5.

Upper Helderberg: Schoharie, New York.

Thamniscus nanus Hall.

1883. Thamniscus nanus. Hall, Trans. Albany Institute, X, p. 161 (abstract, 1881, p. 19).

1887. Thamniscus nanus. Hall and Simpson, Pal. New York, VI, p. 292, pl. lxvi, 11–13.

1897. Thamniscus nanus. Simpson, Fourteenth Ann. Rep. State Geologist New York for the year 1894, pl. ix, 18.

Hamilton: Falls of the Ohio.

Thamniscus ? Niagarensis Hall. See Drymotrypa niagarensis (Hall).

Thamniscus nysa Hall.

1879. Thamniscus Nysa. Hall, Thirty-second Ann. Rep. New York State Museum, p. 175 (reprint, 1880, p. 38); and var., p. 176 (reprint, p. 38).

1883. Thamniscus Nysa. Hall, Rep. State Geologist New York for the year 1882, pl. xxii, 47, 48; and var., pl. xxii, 31, 32.

1887. Thamniscus Nysa. Hall and Simpson, Pal. New York, VI, p. 43, pl. xxii, 31, 32, 47, 48.

1897. Thamnicella Nysa. Simpson, Fourteenth Ann. Rep. State Geologist New York for the year 1894, pl. ix, 4, 5.

Lower Helderberg: Clarksville, New York.

Thamniscus octonarius Ulrich.

1890. Thamniscus octonarius. Ulrich, Geol. Sur. Illinois, VIII, p. 611, pl. lxii, 7–7*b*.

Upper Coal Measures: Greenwood County, Kansas.

Thamniscus pauciramus Hall.

1883. Thamniscus pauciramus. Hall, Trans. Albany Institute, X, p. 197 (abstract, 1881, p. 197).

1884. Thamniscus pauciramus. Hall, Rep. State Geologist New York for the year 1883, p. 60.

1887. Thamniscus pauciramus. Hall and Simpson, Pal. New York, VI, p. 274.

hamniscus pauciramus Hall—Continued.

1891. Thamniscus pauciramus. Hall, Tenth Ann. Rep. State Geologist New York for the year 1890, p. 55; Forty-fourth Ann. Rep. New York State Museum, p. 85.
Hamilton: Monteiths Point, Lake Canandaigua, New York.

hamniscus ramulosus Ulrich.

1890. Thamniscus ramulosus. Ulrich, Geol. Sur. Illinois, VIII, p. 610, pl. lxii, 4–4*b*.
Chester: Sloans Valley, Kentucky; Chester, Illinois.

hamniscus ramulosus var. sevillensis Ulrich. See Thamniscus sevillensis Ulrich.

hamniscus sculptilis Ulrich.

1890. Thamniscus sculptilis. Ulrich, Geol. Sur. Illinois, VIII, p. 608, pl. lxii, 8–8*b*.
Keokuk: Kings Mountain, Kentucky.

Thamniscus sevillensis Ulrich.

1890. Thamniscus ramulosus var. sevillensis. Ulrich, Geol. Sur. Illinois, VIII, p. 610, pl. lv, 6, pl. lxii, 5, 5*a*.
Lower Coal Measures: Seville, Illinois.

Thamniscus variolatus Hall.

1879. Thamniscus variolata. Hall, Thirty-second Ann. Rep. New York State Museum, p. 175 (reprint, 1880, p. 37).
1883. Thamniscus variolata. Hall, Rep. State Geologist New York for the year 1882, pl. xxii, 34–46.
1887. Thamniscus variolata. Hall and Simpson, Pal. New York, VI, p. 41, pl. xxii, 34–46.
1897. Thamniscus variolata. Simpson, Fourteenth Ann. Rep. State Geologist New York for the year 1894, pl. ix, 14.
Lower Helderberg: Clarksville, New York.

Thamnocella Simpson. See Drymotrypa Ulrich.

Thamnocella Cisseis Simpson. See Drymotrypa cisseis (Hall).

Thamnopora Hall (not Steininger). See Thamnotrypa Hall.

Thamnopora divaricata Hall. See Thamnotrypa divaricata (Hall).

THAMNOTRYPA Hall. Genotype: Thamnopora divaricata Hall.

1883. Thamnopora. Hall, Trans. Albany Institute, X, p. 158 (abstract, 1881, p. 16). (Name was preoccupied by Steininger.)
1887. Thamnotrypa. Hall and Simpson, Pal. New York, VI, p. xxi.
1889. Thamnotrypa. Miller, North American Geol. Pal., p. 328.
1897. Thamnotrypa. Simpson, Fourteenth Ann. Rep. State Geologist New York for the year 1894, p. 546.
Obs. Thamnotrypa is probably a synonym of Tæniopora Nicholson.

Thamnotrypa divaricata (Hall).

1883. Thamnopora divaricata. Hall, Trans. Albany Institute, X, p. 158 (abstract, 1881, p. 16).
1883. Thamnopora divaricata. Hall, Rep. State Geologist New York for the year 1882, pl. xxvi, 9, 10.
1887. Thamnotrypa divaricata. Hall and Simpson, Pal. New York, VI, p. 101, pl. xxxiii, 9, 10.
1897. Thamnotrypa divaricata. Simpson, Fourteenth Ann. Rep. State Geologist New York for the year 1894, pl. xii, 7, 8.
Upper Helderberg: Near Buffalo, New York.

Thecostegites hemisphericus F. Roemer. See **Fistulipora** hemispherica (F. Roemer).

TREMATELLA Hall. Genotype: Trematopora annulata Hall.

1886. Trematella. Hall, Fifth Ann. Rep. State Geologist New York for the year 1885, explanation pl. xxv.
1887. Trematella. Hall and Simpson, Pal. New York, VI, p. xiv.
1889. Trematella. Miller, North American Geol. Pal., p. 329.
1897. Trematella. Simpson, Fourteenth Ann. Rep. State Geologist New York for the year 1894, p. 550.
Obs. Trematella is probably a synonym for Batostomella, but until the genotype is better known the present arrangement seems best.

Trematella annulata (Hall).

1883. Trematopora ? annulata. Hall, Trans. Albany Institute, X, p. 147 (abstract, 1881, p. 5).
1883. Trematopora ? annulata. Hall, Rep. State Geologist New York for the year 1882, pl. (26) xxiv, 1, 2.
1886. Trematella annulata. Hall, Fifth Ann. Rep. State Geologist New York for the year 1885, pl. xxv, 22–24.
1887. Trematopora (Trematella) annulata. Hall and Simpson, Pal. New York, VI, p. 69, pl. xxv, 22, 23, pl. xxvi, 1, 2.
1893. Batostomella annulata. Ulrich, Geol. Minnesota, III, p. 229.
1897. Trematella annulata. Simpson, Fourteenth Ann. Rep. State Geologist New York for the year 1894, pl. xix, 6–9.
1883. Trematopora ? annulata var. pronaspina. Hall, Trans. Albany Institute, X, p. 148 (abstract, 1881, p. 6).
Hamilton: Falls of the Ohio.

Trematella arborea (Hall).

1883. Trematopora arborea. Hall, Trans. Albany Institute, X, p. 147 (abstract, 1881, p. 5).
1886. Trematella arborea. Hall, Fifth Ann. Rep. State Geologist New York for the year 1885, pl. xxv, 16–21.
1887. Trematopora (Trematella) arborea. Hall and Simpson, Pal. New York, VI, p. 69, pl. xxv, 16–21.
Hamilton: Falls of the Ohio

Trematella glomerata (Hall).

1886. Trematella glomerata. Hall, Fifth Ann. Rep. State Geologist New York for the year 1885, pl. xxv, 4, 5.
1887. Trematopora (Trematella) glomerata. Hall and Simpson, Pal. New York, VI, p. 70, pl. xxv, 4, 5.
Upper Helderberg: Onondaga Valley, New York.

Trematella nodosa (Hall and Simpson).

1887. Trematopora (Trematella) nodosa. Hall and Simpson, Pal. New York, VI, p. 176.
Hamilton: Jaycox's Run, New York.

Trematella perspinulata (Hall).

1883. Trematopora perspinulata. Hall, Trans. Albany Institute, X, p. 181 (abstract, 1881, p. 181).
1884. Trematopora perspinulata. Hall, Rep. State Geologist New York for the year 1883, p. 11.
1887. Trematopora (Trematella) perspinulata. Hall and Simpson, Pal. New York, VI, p. 175.

Trematella perspinulata (Hall)—Continued.
1893. Batostomella perspinulata. Ulrich, Geol. Minnesota, III, p. 229.
Hamilton: York, New York.

TREMATOPORA Hall. Genotype: Trematopora tuberculosa Hall.
1852. Trematopora. Hall, Pal. New York, II, p. 149.
1860. Trematopora. Eichwald, Lethæa Rossica, I, p. 494.
1877. Trematopora. Dybowski, Die Chætetiden der Ostbaltischen Silur-Form., p. 69.
1887. Trematopora. Hall and Simpson, Pal. New York, VI, p. xiv.
1889. Trematopora. Miller, North American Geol. Pal., p. 328.
1890. Trematopora. Ulrich, Geol. Sur. Illinois, VIII, pp. 373, 418.
1893. Trematopora. Ulrich, Geol. Minnesota, III, p. 308.
1897. Trematopora. Simpson, Fourteenth Ann. Rep. State Geologist New York for the year 1894, p. 591.
Not Trematopora. Ulrich, Jour. Cincinnati Soc. Nat. Hist., V, 1882, pp. 153, 241; ibid., VI, 1883, p. 257 (=Homotrypa).

Trematopora alternata Hall. See Acanthoclema alternatum (Hall).

Trematopora ?? americana Miller.
1881. Trematopora americana. Miller, Jour. Cincinnati Soc. Nat. Hist., IV, p. 312, pl. vii, 5, *5a*.
Burlington: New Mexico.

Trematopora ? annulata Hall. See Trematella annulata (Hall).

Trematopora (Trematella) annulata Hall and Simpson. See Trematella annulata (Hall).

Trematopora annulata var. pronaspina Hall. See Trematella annulata (Hall).

Trematopora annulifer Whitfield. See Lioclemella annulifera (Whitfield).

Trematopora arborea Hall. See Trematella arborea (Hall).

Trematopora (Trematella) arborea Hall and Simpson. See Trematella arborea (Hall).

Trematopora aspera Hall. See Batostomella ? aspera (Hall).

Trematopora (Orthopora) bispinulata Hall and Simpson. See Streblotrypa ? bispinulata (Hall).

Trematopora calloporoides Ulrich.
1890. Trematopora calloporoides. Ulrich, Geol. Sur. Illinois, VIII, p. 420, pl. xxxviii, 1–1*d*.
Trenton: Alexander County, Illinois.

Trematopora camerata Hall. See Chilotrypa camerata (Hall).

Trematopora canaliculata Hall. See Orthopora canaliculata (Hall).

Trematopora (Orthopora) canaliculata Hall. See Orthopora canaliculata (Hall).

Trematopora carinata Whiteaves. See Orthopora carinata (Hall and Simpson).

Trematopora (Orthopora) carinata Hall and Simpson. See Orthopora carinata (Hall and Simpson).

Trematopora claviformis Hall. See Stictoporina claviformis (Hall).

Trematopora coalescens Hall. See Chilotrypa ? coalescens (Hall.)

Trematopora constricta Hall. See Chilotrypa ? constricta (Hall).

Trematopora corticosa Hall. See Eridotrypa corticosa (Hall).

Trematopora (Chætetes) corticosa Hall. See Eridotrypa corticosa (Hall).

Trematopora ? (Trematella ?) corticosa Hall. See Eridotrypa corticosa (Hall).

Trematopora crassa Hall. See Fistulipora crassa (Hall).

Trematopora crebripora Hall. Not recognizable.

1883. Trematopora (Chætetes) crebripora. Hall, Trans. Albany Institute, X, p. 59 (abstract 1879, p. 3).

1882. Trematopora (Chætetes) crebripora. Hall, Eleventh Ann. Rep. Indiana Geol. Nat. Hist., p. 236.

Niagara: Waldron, Indiana.

Trematopora debilis Ulrich.

1890. Trematopora debilis. Ulrich, Geol. Sur. Illinois, VIII, p. 419, pl. xxxiv, 3–3*e*.

Trenton: Alexander County, Illinois.

Trematopora densa Hall. See Monotrypella ? densa (Hall).

Trematopora (Chætetes) densa Hall. See Monotrypella ? densa (Hall).

Trematopora dispersa Hall. See Chilotrypa dispersa (Hall).

Trematopora echinata Hall. See Eridotrypa echinata (Hall).

Trematopora (Orthopora) elongata Hall and Simpson. See Orthopora elongata (Hall and Simpson).

Trematopora ?? fragilis Winchell.

1864. Trematopora fragilis. Winchell, Proc. Acad. Nat. Sci. Philadelphia, p. 3.

Burlington: Burlington, Iowa.

Trematopora (Trematella) glomerata Hall and Simpson. See Trematella glomerata (Hall).

Trematopora (Orthopora) granifera Hall and Simpson. See Orthopora granifera (Hall and Simpson).

Trematopora (Orthopora) granilinea Hall and Simpson. See Orthopora granilinea (Hall and Simpson).

Trematopora ? granistriata Hall. See Bactropora granistriata (Hall).

Trematopora ?? granulata Whitfield.

1878. Trematopora granulata. Whitfield, Ann. Rep. Geol. Sur. Wisconsin for the year 1877, p. 68.

1882. Trematopora granulata. Whitfield, Geol. Sur. Wisconsin, IV, p. 253, pl. xi, 22, 23.

Cincinnati (Richmond): Delafield, Wisconsin.

Obs. This species probably belongs to the genus Eridotrypa.

Trematopora granulifera Hall. See Batostomella granulifera (Hall).

Trematopora halli Ulrich.

1883. Trematopora halli. Ulrich, Jour. Cincinnati Soc. Nat. Hist., VI, p. 261, pl. xiii, 3, 3*a*.

Niagara: Waldron, Indiana.

Trematopora (Orthopora) hexagona Hall and Simpson. See Orthopora hexagona (Hall and Simpson).

Trematopora (Orthopora) immersa Hall and Simpson. See Orthopora immersa (Hall and Simpson).

Trematopora infrequens Hall. See Diamesopora infrequens (Hall).

Trematopora (Orthopora) interplana Hall and Simpson. See Orthopora interplana (Hall and Simpson).

Trematopora (Callopora) irregularis Hall. See Chilotrypa irregularis (Hall).

Trematopora (Orthopora) lineata Hall and Simpson. See Orthopora lineata (Hall and Simpson).

Trematopora ? (Trachypora ?) macropora Hall. See Nematopora macropora (Hall).

Trematopora maculosa Hall. See Fistulipora maculosa (Hall).

Trematopora minuta Hall. See Nematopora minuta (Hall).

Trematopora ? (Trachypora ?) minuta Hall. See Nematopora minuta (Hall).

Trematopora ? nitida Ulrich. See Lioclemella nitida (Ulrich).

Trematopora (Orthopora) nodosa Hall. Not defined.

1887. Trematopora (Orthopora) nodosa. Hall, Pal. New York, VI, pl. xxiii, 10. Lower Helderberg: Clarksville, New York.

Trematopora (Trematella) nodosa Hall and Simpson. See Trematella nodosa (Hall and Simpson).

Trematopora orbipora Hall. See Orthopora orbipora (Hall).

Trematopora (Orthopora ?) orbipora Hall and Simpson. See Orthopora orbipora (Hall).

Trematopora ornata Ulrich. See Trematopora ? primigenia-ornata Ulrich.

Trematopora (Orthopora) ornata Hall and Simpson. See Orthopora ornata (Hall and Simpson).

Trematopora osculum Hall. See Diamesopora osculum (Hall).

Trematopora ostiolata Hall. See Chilotrypa ostiolata (Hall).

Trematopora ovatipora Hall. See Orthopora ovatipora (Hall).

Trematopora (Orthopora) ovatipora Hall and Simpson. See Orthopora ovatipora (Hall).

Trematopora parallela Hall. See Orthopora parallela (Hall).

Trematopora (Orthopora) parallela Hall and Simpson. See Orthopora parallela (Hall).

Trematopora perspinulata Hall. See Trematella perspinulata (Hall).

Trematopora (Trematella) perspinulata Hall and Simpson. See Trematella perspinulata (Hall).

Trematopora polygona Hall. See Orthopora polygona (Hall).

Trematopora (Orthopora) polygona Hall and Simpson. See Orthopora polygona (Hall).

Trematopora ponderosa Hall. See Fistulipora maculosa (Hall).

Trematopora ? primigenia Ulrich.

1886. Trematopora primigenia. Ulrich, Fourteenth Ann. Rep. Geol. Nat. His Sur. Minnesota, p. 97.

1893. Trematopora ? primigenia. Ulrich, Geol. Minnesota, III, p. 309, pl. xxi, 23–40.

Trenton (Black River): Minneapolis, St. Paul, Fountain and Preston, Minnesota.

Trematopora ? primigenia-ornata Ulrich.

1886. Trematopora ornata. Ulrich, Fourteenth Ann. Rep. Geol. Nat. Hist. Sur. Minnesota, p. 98.

1893. Trematopora ? primigenia var. ornata. Ulrich, Geol. Minnesota, III, p. 310. pl. xxi, 26, 28, 33, 34.

Trenton (Black River): Minneapolis and St. Paul, Minnesota.

Trematopora ? primigenia-spinosa Ulrich.

1893. Trematopora ? primigenia var. spinosa. Ulrich, Geol. Minnesota, III, p. 310, pl. xxi, 29, 30, 35, 36.

Trenton (Black River): Minneapolis and St. Paul, Minnesota.

Trematopora ?? punctata Hall.

1852. Trematopora punctata. Hall, Pal. New York, II, p. 151, pl. xlA, 4*a–c*.

Niagara: Lockport, New York.

Trematopora rectilinea Hall. Not recognized.

1883. Trematopora rectilinea. Hall, Trans. Albany Institute, X, p. 148 (abstract, 1881, p. 6).

Upper Helderberg: Onondaga Valley, New York.

Trematopora regularis Hall. See Orthopora regularis (Hall).

Trematopora (Orthopora) regularis Hall and Simpson. See Orthopora regularis (Hall).

Trematopora (Orthopora) reticulata Hall and Simpson. See Orthopora reticulata (Hall).

Trematopora rhombifera Hall. See Orthopora rhombifera (Hall) and Stictopora ?? granatula Hall.

Trematopora (Orthopora) rhombifera Hall and Simpson. See Orthopora rhombifera (Hall).

Trematopora scutulata Hall (Upper Helderberg). See Orthopora scutulata (Hall).

Trematopora scutulata Hall (Hamilton). See Streblotrypa scutulata (Hall).

Trematopora (Orthopora) scutulata Hall (Upper Helderberg). See Orthopora scutulata (Hall).

Trematopora signata Hall. See Callotrypa macropora-signata (Hall).

Trematopora ? singularis (Hall).

1876. Callopora singularis. Hall, Twenty-eighth Ann. Rep. New York State Museum (documentary edition), pl. x, 1, 2; ibid. (Museum edition), p. 115, pl. x, 1, 2.

1882. Callopora singularis. Hall, Eleventh Ann. Rep. Indiana Geol. Nat. Hist., p. 237, pl. ix, 1, 2.

1890. Leioclema singulare. Ulrich, Geol. Sur. Illinois, VIII, p. 425.

Niagara: Waldron, Indiana.

Trematopora ? spiculata Miller.

1876. Trematopora spinulosa. Hall, Twenty-eighth Ann. Rep. New York State Museum (documentary edition), pl. xi, 11, 12. (Not Trematopora spinulosa. Hall, Pal. New York, II, 1852, p. 155, pl. xlA, 11*a*, *b*.)
1877. Trematopora spiculata. Miller, American Pal. Foss., edition 2, p. 245. (Proposed for T. spinulosa, preoccupied by Hall in 1852.)
1879. Trematopora spiculata. Hall, Twenty-eighth Ann. Rep. New York State Museum (Museum edition), p. 114, pl. xi, 11, 12.
1882. Trematopora spiculata. Hall, Eleventh Ann. Rep. Indiana Geol. Nat. Hist., p. 235, pl. x, 11, 12.
Niagara: Waldron, Indiana.

Trematopora solida Hall. See Homotrypa ? solida (Hall).

Trematopora sparsa Hall. See Diploclema sparsum (Hall).

Trematopora spinulosa Hall (1852). See Bythopora spinulosa (Hall).

Trematopora spinulosa Hall (1876). See Trematopora ? spiculata Miller.

Trematopora striata Hall.

1852. Trematopora striata. Hall, Pal. New York, II, p. 153, pl. xlA, 7*a*–*d*.
Niagara: Lockport, New York.
Obs.—This is probably some species of Eridotrypa or Bythopora, but with present knowledge can not be recognized.

Trematopora subimbricata Hall. See Diamesopora subimbricata (Hall).

Trematopora subquadrata Hall. See Orthopora subquadrata (Hall).

Trematopora (Orthopora) subquadrata Hall. See Orthopora subquadrata (Hall).

Trematopora ?? superba Billings.

1866. Trematopora superba. Billings, Catal. Sil. Foss. Anticosti, p. 93.
Clinton and Niagara: Cabots Head, Lake Huron.

Trematopora tortalinea Hall. See Orthopora tortalinea (Hall).

Trematopora (Orthopora) tortalinea Hall and Simpson. See Orthopora tortalinea (Hall).

Trematopora transversa Hall. See Orthopora transversa (Hall).

Trematopora (Orthopora?) transversa Hall and Simpson. See Orthopora transversa (Hall).

Trematopora tuberculosa Hall.

1852. Trematopora tuberculosa. Hall, Pal. New York, II, p. 149, pl. xlA, 1*a*–*g*.
1883. Trematopora tuberculosa. Ulrich, Jour. Cincinnati Soc. Nat. Hist., VI, p. 259, pl. xiii, 2–2*b*.
1897. Trematopora tuberculosa. Simpson, Fourteenth Ann. Rep. State Geologist New York for the year 1894, pl. xix. 1–5.
Niagara: Lockport, New York.

Trematopora tubulosa Hall. See Diamesopora tubulosa (Hall).

Trematopora varia Hall. See Chilotrypa varia (Hall).

Trematopora variolata Hall. See Chilotrypa variolata (Hall).

Trematopora ?? vesiculosa Winchell.

1864. Trematopora vesiculosa. Winchell, Proc. Acad. Nat. Sci. Philadelphia, p. 3.
1865. Trematopora ? vesiculosa. Winchell, Proc. Acad. Nat. Sci. Philadelphia, p. 112.

Trematopora ?? vesiculosa Winchell—Continued.

1870. Trematopora? vesiculosa. Winchell, Proc. American Phil. Soc., XI, p. 247.
Burlington: Burlington, Iowa.
Waverly: Sciotoville, Ohio; Hillsdale, Michigan.

Trematopora whitfieldi Ulrich.

1883. Trematopora whitfieldi. Ulrich, Jour. Cincinnati Soc. Nat. Hist., VI, p. 262, pl. xiii, 4, 4*a*.
Niagara: Waldron, Indiana.

TRIGONODICTYA Ulrich. Genotype: Pachydictya conciliatrix Ulrich.

1893. Trigonodictya. Ulrich, Geol. Minnesota, III, p. 160.

Trigonodictya conciliatrix (Ulrich).

1886. Pachydictya conciliatrix. Ulrich, Fourteenth Ann. Rep. Geol. Nat. Hist. Sur. Minnesota, p. 76.
1893. Trigonodictya conciliatrix. Ulrich, Geol. Minnesota, III, p. 160, pl. ix, 11, 12, pl. x, 15-20.
Trenton (Black River): Cannon Falls, Minnesota.

Trigonodictya eatonensis Ulrich.

1893. Trigonodictya eatonensis. Ulrich, Geol. Minnesota, III, p. 160.
1895. Trigonodictya eatonensis. Foerste, Geol. Sur. Ohio, VII, p. 599.
Clinton: Eaton, Ohio.

TROPIDOPORA Hall and Simpson. Genotype: Tropidopora nana Hall.

1887. Tropidopora. Hall and Simpson, Pal. New York, VI, p. xv.
1889. Tropidopora. Miller, North American Geol. Pal., p. 329.
1897. Tropidopora. Simpson, Fourteenth Ann. Rep. State Geologist New York for the year 1894, p. 553.

Tropidopora nana Hall.

1886. Tropidopora nana. Hall, Fifth Ann. Rep. State Geologist New York for the year 1885, pl. xxv, 25, 26.
1887. Tropidopora nana. Hall and Simpson, Pal. New York, VI, p. 71, pl. xxv, 25, 26.
1897. Tropidopora nana. Simpson, Fourteenth Ann. Rep. State Geologist New York for the year 1894, pl. xvi, 1, 2.
Upper Helderberg: Onondaga Valley, New York.

Tuberculopora Ringueberg. Bryozoan? Genotype: Tuberculopora inflata Ringueberg.

1886. Tuberculopora. Ringueberg, Bull. Buffalo Soc. Nat. Sci., V, p. 21.

Tuberculopora inflata Ringueberg. Not recognizable.

1886. Tuberculopora inflata. Ringueberg, Bull. Buffalo Soc. Nat. Sci., V, p. 21, pl. ii, 18.
Niagara: Lockport, New York.

UNITRYPA Hall. Genotype: Fenestella (Hemitrypa) lata Hall.

1885. Unitrypa. Hall, Rep. State Geologist New York for the year 1884, p. 36.
1886. Unitrypa. Ulrich, Contr. American Pal., I, p. 4.
1887. Unitrypa. Hall and Simpson, Pal. New York, VI, p. xxiii.
1889. Unitrypa. Miller, North American Geol. Pal., p. 329.
1890. Unitrypa. Ulrich, Geol. Sur. Illinois, VIII, p. 396.
1895. Unitrypa. Simpson, Thirteenth Ann. Rep. State Geologist New York for the year 1893, pp. 689, 708, 726; Forty-seventh Ann. Rep. New York State Museum, pp. 883, 902, 920.

UNITRYPA Hall—Continued.

1897. Unitrypa. Simpson, Fourteenth Ann. Rep. State Geologist New York for the year 1894, pp. 508, 520.

1899. Unitrypa. Grabau, Bull. Buffalo Soc. Nat. Sci., VI, p. 161.

Unitrypa acaulis (Hall).

1883. Fenestella (Hemitrypa) acaulis. Hall, Trans. Albany Institute, X, p. 175 (abstract, 1881, p. 33).

1886. Fenestella (Unitrypa) acaulis. Hall, Fifth Ann. Rep. State Geologist New York for the year 1885, pl. li, 1–6.

1887. Fenestella (Unitrypa) acaulis. Hall and Simpson, Pal. New York, VI, p. 131, pl. li, 1–6.

1886. Unitrypa conferta. Ulrich, Contr. American Pal., I, p. 17, pl. i, 8, 8*a*.

1887. Fenestella (Unitrypa) projecta. Hall and Simpson, Pal. New York, VI, p. 132.

1888. Fenestella (Unitrypa) projecta. Hall, Seventh Ann. Rep. State Geologist New York for the year 1887, pl. xiv, 6–8; Forty-first Ann. Rep. New York State Museum, pl. xiv, 6–8.

Hamilton: Falls of the Ohio.

Unitrypa acaulis-inclinis (Hall and Simpson).

1887. Fenestella (Unitrypa) acaulis var. inclinis. Hall and Simpson, Pal. New York, VI, p. 132.

Hamilton: Falls of the Ohio.

Obs. The differences between this form and Unitrypa acaulis are scarcely of varietal importance.

Unitrypa acclivis (Hall and Simpson).

1887. Fenestella (Unitrypa) acclivis. Hall and Simpson, Pal. New York, VI, p. 138, pl. lii, 16–23.

1897. Unitrypa acclivis. Simpson, Fourteenth Ann. Rep. State Geologist New York for the year 1894, pl. v, 15.

Upper Helderberg: Walpole, Ontario.

Unitrypa anonyma (Hall).

1883. Fenestella (Hemitrypa) anonyma. Hall, Trans. Albany Institute, X, p. 176 (abstract, 1881, p. 34).

Hamilton: Falls of the Ohio.

Unitrypa conferta Ulrich. See Unitrypa acaulis (Hall).

Unitrypa connexa Simpson.

1897. Unitrypa connexa Hall. Simpson, Fourteenth Ann. Rep. State Geologist New York for the year 1894, pl. v, 12–14.

Obs. Simpson ascribes this species to Hall, but we have been unable to find it in any of Hall's works. The species apparently has not yet been described; until described the name is invalid.

Unitrypa ? elegantissima (Hall).

1883. Fenestella (Hemitrypa) elegantissima. Hall, Trans. Albany Institute, X, p. 177 (abstract, 1881, p. 35).

1886. Fenestella (Unitrypa) elegantissima. Hall, Fifth Ann. Rep. State Geologist New York for the year 1885, pl. liii, 12–17.

1887. Fenestella (Unitrypa) elegantissima. Hall and Simpson, Pal. New York, VI, p. 140, p. liii, 12–17.

Upper Helderberg: Walpole, Ontario.

Unitrypa fastigata (Hall).

1883. Fenestella (Hemitrypa) fastigata. Hall, Trans. Albany Institute, X, p. 178 (abstract, 1881, p. 36).
1887. Fenestella (Unitrypa) fastigata. Hall and Simpson, Pal. New York, VI, p. 141, pl. liv. 1–6.
1897. Unitrypa fastigata. Simpson, Fourteenth Ann. Rep. State Geologist New York for the year 1894, fig. 54 (p. 508), pl. vi, 1–6.
Hamilton: Falls of the Ohio.

Unitrypa ficticia (Hall and Simpson).

1887. Fenestella (Unitrypa) ficticia. Hall and Simpson, Pal. New York, VI, p. 137. pl. lii, 11–15.
Upper Helderberg: Walpole, Ontario.

Unitrypa lata (Hall).

1883. Fenestella (Hemitrypa) lata. Hall, Trans. Albany Institute, X, p. 176 (abstract, 1881, p. 34).
1885. Unitrypa spatiosa (in error). Hall, Rep. State Geologist New York for the year 1884, pl. ii, 12.
1887. Fenestella (Unitrypa) lata. Hall and Simpson, Pal. New York, VI, p. 136, pl. lii, 1–10.
1897. Unitrypa lata. Simpson, Fourteenth Ann. Rep. State Geologist New York for the year 1894, figs. 55–57 (pp. 508–509), pl. v, 16–19.
Upper Helderberg: Walpole, Ontario.

Unitrypa nana (Hall and Simpson).

1887. Fenestella (Unitrypa) nana. Hall and Simpson, Pal. New York, VI, p. 133.
Upper Helderberg: Walpole, Ontario.

Unitrypa nervia (Hall).

1874. Fenestella Nervia. Hall, Twenty-sixth Ann. Rep. New York State Museum, p. 93.
1879. Fenestella (Hemitrypa) Nervia. Hall, Thirty-second Ann. Rep. New York State Museum, p. 173 (reprint, 1880, p. 35).
1883. Fenestella (Hemitrypa) Nervia. Hall, Rep. State Geologist New York for the year 1882, pl. xxii, 1–6, ? 9, 10.
1887. Fenestella (Unitrypa) Nervia. Hall and Simpson, Pal. New York, VI, p. 55, pl. xxii, 1–3, 6, ? 9, 10.
1874. Hemitrypa prima. Hall, Twenty-sixth Ann. Rep. New York State Museum, p. 98.
Lower Helderberg: Clarksville and Schoharie, New York.

Unitrypa nervia-constricta (Hall).

1879. Fenestella (Hemitrypa) Nervia var. constricta. Hall, Thirty-second Ann. Rep. New York State Museum, p. 174 (reprint, 1880, p. 36).
1883. Fenestella (Hemitrypa) Nervia var. constricta. Hall, Rep. State Geologist New York for the year 1882, pl. xxii, 11, 12.
1887. Fenestella (Unitrypa) Nervia var. constricta. Hall and Simpson, Pal. New York, VI, p. 56, pl. xxii, 11, 12.
Lower Helderberg: Clarksville, New York.

Unitrypa pernodosa (Hall).

1883. Fenestella (Hemitrypa) pernodosa. Hall, Trans. Albany Institute, X, p. 176 (abstract, 1881, p. 35).
1886. Fenestella (Unitrypa) pernodosa. Hall, Fifth Ann. Rep. State Geologist New York for the year 1885, pl. liii, 1–11.

Unitrypa pernodosa (Hall)—Continued.
1887. Fenestella (Unitrypa) pernodosa. Hall and Simpson, Pal. New York, VI, p. 139, pl. liii, 1–11.
Upper Helderberg: Walpole, Ontario.

Unitrypa præcursor (Hall).
1874. Fenestella præcursor. Hall, Twenty-sixth Ann. Rep. New York State Museum, p. 94.
1879. Fenestella præcursor. Hall, Thirty-second Ann. Rep. New York State Museum, p. 171 (reprint, 1880, p. 33).
1883. Fenestella præcursor. Hall, Rep. State Geologist New York for the year 1882, pl. xxi, 14–18.
1885. Fenestella (Unitrypa) præcursor. Hall, Rep. State Geologist New York for the year 1884, pl. ii, 10.
1887. Fenestella (Unitrypa) præcursor. Hall and Simpson, Pal. New York, VI, p. 54, pl. xxi, 14–18.
Lower Helderberg: Catskill and Clarksville, New York.

Unitrypa quadrula (Hall).
1879. Fenestella quadrula. Hall, Thirty-second Ann. Rep. New York State Museum, p. 172 (reprint, 1880, p. 34).
1883. Fenestella quadrula. Hall, Rep. State Geologist New York for the year 1882, pl. xxi, 19–22.
1887. Fenestella quadrula. Hall and Simpson, Pal. New York, VI, p. 53, pl. xxi, 19–22.
1890. Unitrypa quadrula. Ulrich, Geol. Sur. Illinois, VIII, p. 534.
Lower Helderberg: Clarksville, New York.

Unitrypa retrorsa Ulrich. See Unitrypa tegulata (Hall).

Unitrypa scalaris (Hall).
1884. Fenestella scalaris. Hall, Thirty-sixth Ann. Rep. New York State Museum, p. 66.
1887. Fenestella (Unitrypa) scalaris. Hall, Sixth Ann. Rep. State Geologist New York for the year 1886, p. 60.
1888. Fenestella (Unitrypa) scalaris. Hall, Seventh Ann. Rep. State Geologist New York for the year 1887, pl. xi, 1–11; Forty-first Ann. Rep. New York State Museum, pl. xi, 1–11.
1899. Unitrypa scalaris. Grabau, Bull. Buffalo Soc. Nat. Sci., VI, p. 162, fig. 51.
Hamilton: Bellona and other localities in New York; West Williams, Ontario.

Unitrypa spatiosa Hall. See Unitrypa lata (Hall).

Unitrypa substriata (Hall).
1883. Fenestella (Hemitrypa) substriata. Hall, Trans. Albany Institute, X, p. 177 (abstract, 1881, p. 35).
Upper Helderberg: Falkirk, New York.

Unitrypa tegulata (Hall).
1883. Fenestella (Hemitrypa) tegulata. Hall, Trans. Albany Institute, X, p. 176 (abstract, 1881, p. 34).
1886. Fenestella (Unitrypa) tegulata. Hall, Fifth Ann. Rep. State Geologist New York for the year 1885, pl. li, 15–23.
1887. Fenestella (Unitrypa) tegulata. Hall and Simpson, Pal. New York, VI, p. 135, pl. li, 15–23.
1883. Fenestella (Hemitrypa) stipata. Hall, Trans. Albany Institute, X, p. 175 (abstract, 1881, p. 34).

Unitrypa tegulata (Hall)—Continued.

1886. Fenestella (Unitrypa) stipata. Hall, Fifth Ann. Rep. State Geologist New York for the year 1885, pl. li, 7–14.
1887. Fenestella (Unitrypa) stipata. Hall and Simpson, Pal. New York, VI, p. 134, pl. li, 7–14.
1886. Unitrypa retrorsa. Ulrich, Contr. American Pal., I, p. 15, pl. i, 7–7*c*.
1887. Fenestella (Unitrypa) transversa. Hall and Simpson, Pal. New York, VI, p. 132.
1888. Fenestella (Unitrypa) transversa. Hall, Seventh Ann. Rep. State Geologist New York for the year 1887, pl. xiv, 9; Forty-first Ann. Rep. New York State Museum, pl. xiv, 9.
Hamilton: Falls of the Ohio.

VINELLA Ulrich. Genotype: Vinella repens Ulrich.

1890. Vinella. Ulrich, Jour. Cincinnati Soc. Nat. Hist., XII, p. 173.
1892. Vinella. Miller, North American Geol. Pal., First Appendix, p. 685.
1893. Vinella. Ulrich, Geol. Minnesota, III, p. 112.
1897. Vinella. Simpson, Fourteenth Ann. Rep. State Geologist New York for the year 1894, p. 604.

Vinella radialis Ulrich.

1893. Vinella radialis. Ulrich, Geol. Minnesota, III, p. 113, fig. 8*b*.
Cincinnati (Lorraine): Cincinnati, Ohio.

Vinella radiciformis-conferta Ulrich.

1893. Vinella radiciformis var. conferta. Ulrich, Geol. Minnesota, III, p. 113, fig. 8*c*, *d*.
Niagara: Waldron, Indiana.

Vinella repens Ulrich.

1890. Vinella repens. Ulrich, Jour. Cincinnati Soc. Nat. Hist., XII, p. 174. fig. 1.
1893. Vinella repens. Ulrich, Geol. Minnesota, III, p. 114, pl. i, 1–5.
1897. Vinella repens. Simpson, Fourteenth Ann. Rep. State Geologist New York for the year 1894, fig. 222 (p. 604).
Trenton (Black River): St. Paul, Minnesota.

WORTHENOPORA Ulrich. Genotype: Worthenopora spinosa Ulrich.

1890. Worthenopora. Geol. Sur. Illinois, VIII, p. 403.
1889. Worthenopora. (Ulrich, in press), Miller, North American Geol. Pal., p. 330.
1897. Worthenopora. Simpson, Fourteenth Ann. Rep. State Geologist New York for the year 1894, p. 602.

Worthenopora spatulata (Prout).

1859. Flustra spatulata. Prout, Trans. St. Louis Acad. Sci., I, p. 446, pl. xvii, 2–2*c*.
1890. Worthenopora spatulata. Ulrich, Geol. Sur. Illinois, VIII, p. 670, pl. lxviii, 2, 2*a*.
1894. Worthenopora spatulata. Keyes, Missouri Geol. Sur., V, p. 36.
Warsaw: Warsaw, Illinois; Barretts Station, Missouri.

Worthenopora spinosa Ulrich.

1890. Worthenopora spinosa. Ulrich, Geol. Sur. Illinois, VIII, p. 669, pl. lxviii, 1–1*g*.
1894. Worthenopora spinosa. Keyes, Missouri Geol. Sur., V, p. 36.
1897. Worthenopora spinosa. Simpson, Fourteenth Ann. Rep. State Geologist New York for the year 1894, figs. 217–219 (p. 603).
Keokuk: Warsaw and Nauvoo, Illinois; Keokuk and Bentonsport, Iowa.

INDEX OF SPECIFIC NAMES.

abrupta—Batostomella.
  —Monotrypella.
abruptus (Chætetes)—Monotrypella.
acaulis —Unitrypa.
acaulis-inclinis—Unitrypa.
acclivis—Unitrypa.
acervulosa—Fistulipora.
  —Leptotrypa.
acmeum—Semicoscinium.
aculeata—Polypora.
aculeolata—Cœlocaulis.
acuminata—Escharopora.
acuta—Pachydictya.
  —Ptilopora.
  (Ptilodictya)—Pachydictya.
  (Stictopora)—Pachydictya.
acuticosta—Fenestella.
adherens—Stenopora.
adnata—Hederella.
  —Reteporidra.
  (Fenestella)—Reteporidra.
  (Nicholsonia)—Hederella.
adornata—Fenestella.
adraste—Fenestella.
æqualis—Fenestella.
  —Monotrypella.
  (Monticulipora)—Monotrypella.
aequidistans—Chætetes.
æsyle—Fenestella.
affinis—Heterotrypa.
  —Prasopora.
  (Amplexopora)—Heterotrypa.
  (Monticulipora)—Heterotrypa.
agellus—Ceramopora confluens.
albida—Fenestella.
albida-richfieldensis—Fenestella richfieldensis.
albionensis—Polypora.
alcicornis—Bythopora.
  —Clathropora.
alcyone—Pachydictya.
alternata—Fistulipora.
  —Hederella.
  —Helopora.
  —Nematopora.
  —Stictopora.
  (Ceramopora)—Cœloclema.
alternata (Lichenalia)—Fistulipora.
  (Monticulipora)—Cœloclema.
  (Stomatopora)—Hederella.
  (Trematopora)—Acanthoclema.
alternatum—Acanthoclema.
  —Cœloclema.
althæa—Fenestella.
alveata (Lichenalia)—Buskopora bistriata.
ambigua—Loculipora.
  —Sagenella.
  (Fenestella)—Loculipora.
  (Isotrypa)—Loculipora.
americana—Acanthocladia.
  —Cystodictya.
  —Stenopora.
  —Trematopora.
americana-varsoviensis—Stenopora.
ampla—Callopora.
amplectens—Monotrypa.
  (Paleschara)—Leptotrypa quadrangularis.
amplexa—Streblotrypa.
anastomosa—Omniretepora.
anceps—Acanthocladia americana.
andrewsi—Callopora.
angulare—Arthroclema.
angularis—Callopora.
  —Cystodictya.
  —Escharopora.
  —Stenopora.
  —Stictoporella.
  (Stictopora)—Cystodictya.
angularis-intermedia—Stictoporella.
angulata—Fenestella.
  —Nicholsonia.
  —Phylloporina.
  (Retepora)—Phylloporina.
  (Subretepora)—Phylloporina.
angusta—Cystodictya.
  —Ptilodictya.
  (Escharopora)—Ptilodictya.
angustata—Fenestella.
  —Rhombopora.
annulata—Trematella.
annulata-pronaspina—Trematella annulata.

annulifera—Lioclemella.
anonyma—Unitrypa.
antheloidea—Stellipora.
(Constellaria) — Constellaria constellata.
(Hellipora)—Constellaria constellata.
(Stellipora)—Constellaria constellata.
anticorum—Gorgonia.
antiqua (Ptilodictya)—Eurydictya multipora.
aperta—Fenestella.
—Meekopora.
appressa—Dekayia.
—Eridotrypa.
(Monotrypella)—Eridotrypa.
approximata—Meekopora.
—Polypora.
—Scalaripora.
(Helopora) — Bythopora parvula.
approximatus (Chætetes)—Callopora dalei.
(Monticulipora)—Callopora dalei.
arachnoidea—Stomatopora.
araneum—Lioclema.
arborea—Monticulipora.
—Trematella.
(Trematopora)—Trematella.
arbuscula—Homotrypa.
arbuscula—Monotrypella.
arbusculus (Chætetes)—Monotrypella.
archimedes (Retepora)—Archimedes wortheni.
archimediformis (Helicopora)—Archimedes laxus.
arcolata (Monticulipora) — Aspidopora areolata.
arctipora—Bythopora.
areolata—Aspidopora.
—Spatiopora.
arguta—Pachydictya crassa.
arkonensis—Fenestella.
—Polypora.
armata—Helopora.
—Rhombopora.
armatum—Arthroclema.
arta—Polypora.
ascuta—Thamnicella.
aspectans—Polypora.
aspectus (Fenestella)—Polypora aspectans.
aspera—Batostomella.
—Dekayia.
—Hemitrypa.
—Phyllopora.
—Phylloporina.
—Spatiopora.
(Callopora)—Lioclema.
(Gorgonia)—Phylloporina.
(Lichenotrypa)—Lichenotrypa longispina.
(Monticulipora)—Spatiopora.
(Monticulipora (Dekayia))—Dekayia.
(Paleschara) — Paleschara maculata.
(Subretepora)—Phylloporina.
(Trematopora)—Batostomella.
asperato-striata—Phylloporina.
asperum—Lioclema.
asperrima (Rhombopora)—Rhombopora asperula.
asperula—Petigopora.
—Rhombopora.
(Monticulipora)—Petigopora.
assita—Fenestella.
asteria—Fistulipora.
asterias (Coscinium)—Fistulipora.
astrica—Fistulipora.
astricta—Fistulipora astrica.
attenuata—Rhombopora.
attrita (Dekayia)—Dekayia aspera.
attritus (Chætetes)—Dekayia aspera.
auloporoides—Proboscina.
banyana—Fenestella.
barrandei—Heterotrypa.
barrisi—Euspilopora.
basalis—Intrapora.
—Rhinidictya.
(Stictopora)—Rhinidictya.
(Stictoporella)—Intrapora.
beani—Paleschara.
bellistriata—Fenestella.
bellula—Helopora.
—Pinnatopora.
biarmica (Polypora)—Polypora biseriata.
bicornis—Fenestella.
bifaria (Isotrypa)—Isotrypa conjunctiva.
bifolia—Heliotrypa.
bifoliata—Ptilodictya nebulosa.
bifurca—Ptiloporella.
bifurcata—Arthropora.
—Cystodictya.
—Diploporaria.
—Fenestella.

- bifurcata—Pachydictya.
  - (Eschara)—Pachydictya.
  - (Stictopora)—Cystodictya.
- bifurcata-instabilis—Pachydictya.
- bigeneris—Fenestella perplexa.
- biimbricatum—Semicoscinium.
- bilateralis—Goniotrypa.
  - —Paleschara.
- billingsi—Arthroclema.
  - —Monticulipora.
- biperforata—Fenestrapora.
  - (Tectulipora)—Loculipora loculata.
- bipunctata (Callopora)—Streblotrypa.
  - (Ptilodictya)—Phænopora expansa.
- biordo—Hemitrypa.
- biserialis—Diploporaria.
  - —Hemitrypa.
  - —Septopora.
  - (Fenestella)—Hemitrypa.
  - (Synocladia)—Septopora.
- biserialis-exilis—Hemitrypa.
- biserialis-gracilis—Septopora.
- biserialis-nervata—Septopora.
- biseriata—Fenestella.
- biserrulatum—Semicoscinium.
- bispinulata—Orthopora.
  - (Callopora)—Orthopora.
  - (Trematopora)—Streblotrypa.
- bispinulatum (Acanthoclema)—Orthopora.
- bistigmata—Semiopora.
- bistriata—Buskopora.
- blandida—Polypora.
- briarea (Monticulipora)—Eridotrypa.
  - (Monotrypella)—Eridotrypa.
- briareus—Eridotrypa.
  - —Escharopora.
  - (Chætetes)—Eridotrypa.
  - (Ptilodictya)—Escharopora.
- brevilinea (Fenestella)—Semicoscinium exornatum.
- brevisulcata—Polypora.
- bristolensis (Stictopora)—Cystodictya bifurcata.
- bulbosa—Stenopora.
- bullata—Fistulipora.
- burlingtonensis—Fenestella.
  - —Polypora.
- calceola—Leptotrypa.
- calhounensis—Eurydictya.
- calloporoides—Trematopora.
- callosa—Homotrypa.
- calycula—Aspidopora.
- calyculus (Chætetes)—Aspidopora.
- camerata—Chilotrypa.
- canadense—Batostoma.
- canadensis—Fistulipora.
  - —Hederella.
  - —Ptilodictya.
  - —Scalaripora.
  - —Stomatopora.
  - (Alecto)—Hederella.
  - (Amplexopora)—Batostoma.
  - (Aulopora)—Hederella.
  - (Nicholsonia)—Hederella.
- canaliculata—Orthopora.
- cannonensis—Monticulipora.
- carbaseoides—Flustra.
- carbonaria—Cystodictya.
  - —Fistulipora.
  - —Stenopora.
  - (Ptilodictya)—Cystodictya.
- carbonaria-conferta—Stenopora.
- carbonaria-maculosa—Stenopora.
- carbonarius (Chætetes)—Stenopora.
- carinata—Lichenalia.
  - —Orthopora.
  - —Pinnatopora.
  - (Clathropora)—Coscinium cribriforme.
  - (Coscinotrypa)—Coscinium cribriforme.
  - (Glauconome)—Pinnatopora.
  - (Trematopora)—Orthopora.
- carinella—Polypora.
- cavernosa—Fenestella.
  - (Lichenotrypa)—Lichenotrypa longispina.
- cellulosum—Lioclema.
- celsipora—Polypora.
- celsipora-minima—Polypora.
- celsipora-minor—Polypora.
- cervicornis—Callopora.
- cestriensis—Fenestella.
  - —Polypora.
  - —Septopora.
  - —Stenopora.
  - (Septopora) (M. & W.)—Septopora subquadrans.
- cincinnatiensis—Monticulipora.
  - (Callopora)—Lioclema occidens.
  - (Chætetes)—Monticulipora.
  - (Ptilodictya)—Arthropora shafferi-cleavelandi.

cinctosum—Mitoclema.
cinctura (Lyropora)—Reteporidra cinctuta.
cinctuta—Reteporidra.
cingulata—Amplexopora.
—Fenestella.
—Tæniodictya.
circe—Helopora.
circincta—Selenopora.
circularis—Calloporella.
circumstata—Loculipora.
cirrhosa—Hederella.
cisseis—Drymotrypa.
clathrata—Fenestella.
—Phylloporina.
(Intricaria)—Phylloporina.
(Subretepora)—Phylloporina.
clathratula (Stictopora)—Escharopora pavonia.
clathratulus (Chætetes)—Escharopora pavonia.
clausa—Meekopora.
clavacoidea—Leptotrypa.
claviformis—Leptotrypa.
—Stictoporina.
(Stictopora)—Stictoporina.
(Trematopora)—Stictoporina.
clavis—Leptotrypa.
cleavelandi—Monticulipora.
cleia—Fenestella.
cleis—Semicoscinium.
clintonensis—Monticulipora.
(Clathropora)—Clathropora frondosa-clintonensis.
(Ptilodictya)—Ptilodictya nodosa.
clintonii—Retepora.
clivulata—Eridopora.
clypeiformis—Ceramopora.
coalescens—Chilotrypa.
—Reteporina.
(Fenestella)—Reteporina.
(Trematopora)—Chilotrypa.
colliculata—Fistulipora.
—Monotrypa.
(Lichenalia)—Fistulipora.
colliculatus (Chætetes)—Monotrypa.
collina—Cyclotrypa.
columeliata—Hemitrypa.
columnaris—Chætetes.
communis—Archimedes.
—Cyclotrypa.
(Diamesopora)—Cœloclema concentricum.
communis (Fistulipora)—Cyclotrypa.
(Monticulipora)—Callopora onealli-communis.
compacta—Fenestralia.
—Polypora.
(Fenestella)—Polypora.
compactus—Archimedes.
complanata—Polypora.
complexa—Selenopora.
complexata—Selenopora complexa.
compressa—Fenestella.
—Fistulipora.
—Peronopora.
—Petalotrypa.
—Polypora.
(Fenestella) (Hall)—Polypora.
(Monticulipora)—Peronopora.
(Stictopora)—Phænopora magna.
compressa-nododorsalis—Fenestella nododorsalis.
compressus (Chætetes)—Peronopora.
concava—Helopora.
concentrica—Cystodictya.
—Lichenalia.
—Paleschara.
(Ceramopora)—Cœloclema.
(Eschara)—Cystodictya.
(Lichenotrypa)—Fistulipora neglecta.
concentrica-maculata—Fistulipora neglecta-maculata.
concentrica-parvula—Fistulipora halli.
concentricum—Cœloclema.
conciliatrix—Trigonodictya.
conferta—Hederella.
—Nematopora.
—Pinnatopora.
—Polypora.
(Fenestella)—Polypora.
(Ptilionella)—Hederella.
(Unitrypa)—Unitrypa acaulis.
confertipora (Fenestella)—Ptiloporella bifurca.
(Fistulipora)—Lioclema.
(Fistuliporina)—Lioclema.
(Thallostigma)—Lioclema.
confertiporum—Lioclema.
confluens—Acanthoclema.
—Ceramopora.
—Escharopora.
—Homotrypa.
(Monotrypella)—Homotrypa.
(Rhombopora)—Acanthoclema.

- confusa—Fistulipora.
  - —Proboscina.
  - (Alecto)—Proboscina.
  - (Lichenalia)—Fistulipora.
- confusa (Stomatopora)—Proboscina.
- conica—Ptiloporina.
- conjunctiva—Isotrypa.
- conjunctus—Arthrostylus.
- connexa—Unitrypa.
- conoidea—Prasopora.
- conradi—Fenestella.
- consimilis—Isotrypa.
  - —Monotrypella.
  - (Chætetes)—Monotrypella.
  - (Fenestella)—Isotrypa.
  - (Monticulipora)—Monticulipora lævis-consimilis.
  - (Tectuliporella)—Isotrypa.
- constellata—Constellaria.
  - —Phænopora.
  - (Ceriopora)—Constellaria.
- constellata-plana—Constellaria.
- constellata-prominens—Constellaria.
- constellatus (Chætetes)—Constellaria.
- constricta—Chilotrypa.
  - —Fistulipora.
  - —Phacelopora.
  - (Diamesopora)—Chilotrypa.
  - (Fistuliporella)—Fistulipora.
  - (Lichenalia)—Fistulipora.
  - (Trematopora)—Chilotrypa.
- contexta—Homotrypella.
- contigua—Prasopora.
- conulata—Fistulipora.
- cornuta—Fistulipora.
- cornutum—Arthroclema.
- coronis—Semicoscinium.
- corrugata—Fistulipora.
- cortex—Leptotrypa.
- corticans—Spatiopora.
- corticata—Fenestella.
- corticosa—Eridotrypa.
  - —Phylloporina.
  - —Polypora.
  - (Chætetes)—Eridotrypa.
  - (Phyllopora)—Phylloporina.
  - (Subretepora)—Phylloporina.
  - (Trematopora)—Eridotrypa.
- cosciniformis—Coscinella.
- crassa—Atactoporella.
  - —Fistulipora.
  - —Pachydictya.
  - —Polypora.
  - —Rhombopora.
- crassa (Fistulipora) (Rom.)—Fistulipora romingeri.
  - (Lichenalia)—Fistulipora.
  - (Ptilodictya)—Pachydictya.
  - (Stictopora)—Pachydictya.
  - (Trematopora)—Fistulipora.
- crassimuralis—Monotrypella.
- crebripora—Fenestella.
  - —Trematopora.
- crebriramus—Chætetes.
- crenulata—Callopora.
  - (Cystodictya)—Cystodictya subrigida.
  - (Stictopora)—Cystodictya subrigida.
- crebescens—Polypora.
- crescens—Cystodictya.
- cribriforme—Coscinium.
- cribriformis-carinata (Coscinotrypa)—Coscinium cribriforme.
- cribrosa—Fenestella.
  - —Hemitrypa.
  - —Stictoporella.
  - (Fenestella) (Hall)—Hemitrypa.
  - (Fenestella) (Nich.)—Fenestella nicholsoni.
- crispata—Cystodictya gilberti.
- cristata—Phractopora.
- cristata-lineata—Phractopora cristata.
- cruciformis (Ptilodictya)—Escharopora falciformis.
- crustacea—Lichenalia.
- crustulata (Monticulipora)—Chætetes.
- crustulatus—Chætetes.
- cultellata—Fistulipora.
  - (Fenestella)—Polypora shumardi.
  - (Lichenalia)—Fistulipora.
  - (Polypora)—Polypora shumardi.
- cultrata—Fenestella.
- cumulata—Monotrypa.
  - —Nicholsonella.
  - (Monticulipora)—Nicholsonella.
- curtus—Arthrostylus.
- curvata—Bactropora.
  - —Fenestella.
  - —Homotrypa.
  - —Pinnatopora.
  - (Monticulipora)—Homotrypa.
  - (Rhinopora)—Rhinopora verrucosa.
- curvijunctura—Fenestella.

- cyclops (Coscinium)—Clathropora intertexta.
- cylindracea—Polypora.
  - —Ptilopora.
  - (Fenestella)—Polypora.
- dalei—Callopora.
- dalii (White)—Monticulipora.
  - (Monticulipora) (Hall)—Callopora ramosa.
- davidsoni—Semicoscinium.
- dawsoni—Homotrypa.
  - —Phylloporina.
  - (Monticulipora)—Homotrypa.
  - (Subretepora)—Phylloporina.
- debilis—Trematopora.
- decipiens—Batostoma.
  - —Lioclema.
  - —Peronopora.
  - —Rhombopora.
  - —Septopora.
  - (Chætetes)—Peronopora.
  - (Fistulipora)—Lioclema.
  - (Thallostigma)—Lioclema.
- delicata—Fenestella.
  - —Petalotrypa.
- delicatula—Bythopora.
  - —Fenestella.
  - —Nematopora.
  - —Septopora.
  - —Stomatopora.
  - (Hippothoa)—Stomatopora.
  - (Monticulipora)—Bythopora.
- delicatula-tenuissima—Stomatopora.
- delicatulus (Chætetes)—Bythopora.
- dendrina—Bythopora.
- densa—Monotrypella.
  - (Fistulipora)—Lioclema.
  - (Thallostigma)—Lioclema.
  - (Trematopora)—Monotrypella.
- densus (Chætetes)—Monotrypella.
- densum—Lioclema.
- dentata—Buskopora.
- denticulata—Eridopora.
  - —Streblotrypa.
  - (Lichenalia)—Eridopora.
  - (Pileotrypa)—Eridopora.
- depressa—Fenestella.
- dermata—Strotopora.
- devonica—Dekayia.
  - —Discotrypa.
- dichotoma—Diamesopora.
  - —Drymotrypa.
  - —Rhombopora.
  - (Hornera)—Thamniscus
- dichotoma (Stictopora)—Tæniopora subcarinata.
  - (Subretepora)—Thamniscus.
- dichotomus—Thamniscus.
- dictyotum—Coscinium.
- diffusa—Drymotrypa.
- digitatum—Lioclema.
- dilata—Fenestella.
  - (Prismopora)—Prismopora dilatata.
- dilatata—Prismopora.
- discoidea—Amplexopora.
  - —Mesotrypa.
  - —Proutella.
  - (Cyclopora)—Proutella.
  - (Leptotrypa)—Amplexopora.
  - (Monticulipora)—Amplexopora.
- discoideus (Chætetes)—Amplexopora.
- dispanda—Fenestella.
- disparilis—Ptiloporina.
- dispersa—Chilotrypa.
- dissimilis—Paleschara.
- distans—Archimedes.
  - —Fistulipora.
  - —Polypora.
  - (Fenestella)—Polypora.
  - (Lichenalia)—Fistulipora.
- distensa—Fistulipora.
- distincta—Ceramoporella.
  - —Polypora.
  - —Streblotrypa.
- distorta (Escharina)—Rhinopora verrucosa.
- divaricans—Thamniscus.
- divaricata—Helopora.
  - —Thamnotrypa.
  - (Thamnopora)—Thamnotrypa.
- divergens—Acanthoclema.
  - —Lyropora.
  - —Stictopora.
- diversa—Callopora.
- dubia—Diplotrypa.
  - (Hemitrypa)—Loculipora ambigua.
  - (Monticulipora)—Diplotrypa.
  - (Ptilodictya)—Arthropora shafferi-cleavelandi.
- dumalis—Callopora.
- dumosa—Stictoporella.
- duogeneris—Tæniopora exigua.
- dychei—Leptotrypa.
- eatonensis—Trigonodictya.
- eccentrica—Aspidopora.

echinata—Eridotrypa.
egenus—Chætetes.
ehrenbergi—Phyllopora.
elegans—Berenicea.
—Dichotrypa.
—Discotrypa.
—Fenestella.
—Glyptopora.
—Helopora.
—Pachydictya.
—Pinacotrypa.
(Chætetes)—Discotrypa.
(Coscinium)—Glyptopora.
(Fistulipora)—Pinacotrypa.
(Monticulipora)—Discotrypa.
(Polypora)—Polypora idothea.
(Sagenella)—Berenicea.
elegantissima—Unitrypa.
elegantula—Aspidopora.
—Callopora.
—Coscinella.
—Intrapora.
—Rhombopora.
—Stictopora.
(Anisotrypa)—Rhombopora.
elevatipora—Fenestella.
elongata—Orthopora.
—Polypora.
(Fenestella)—Polypora.
(Trematopora)—Orthopora.
emacerata—Dicranopora.
emarcescens—Ptilodictya expansa-emarcescens.
emaciata—Fenestella.
—Pachydictya.
—Stenopora.
ensiformis—Phænopora.
epidermata—Bythotrypa.
erecta (Crateripora)—Arthropora shafferi.
erectipora—Fenestella.
eriense—Semicoscinium.
eriensis—Fistulipora.
escharense—Coscinium.
eudora—Polypora.
(Fenestella)—Polypora.
(Fenestella) (Hall, 1883)—Polypora stricta.
everetti—Pachydictya.
excellens—Fistulipora.
—Phænopora.
(Ptilodictya)—Phænopora.
(Stictoporella)—Phænopora.
exigua—Eridotrypa.
exigua—Fenestella.
—Protocrisina.
—Rhinidictya.
—Rhombopora.
—Stictoporella.
—Tæniopora.
exilis—Homotrypa.
—Rhombopora.
(Stenopora)—Rhombopora.
eximia—Fenestella.
—Meekopora.
exornatum—Semicoscinium.
expansa—Ceramopora.
—Phænopora.
—Ptilodictya.
(Alveolites)—Ceramopora.
(Ptilodictya)—Phænopora.
expansa-emarcescens—Ptilodictya.
expansus—Chætetes.
expatiata—Cyclopora.
—Dichotrypa.
explanata—Ceramopora.
—Phænopora.
explicans—Ptilodictya.
exsul—Lioclema.
facula—Sceptropora.
falcata—Limaria.
falciformis—Escharopora.
falesi—Monticulipora.
famelica—Pachydictya.
farctus (Ptilodictya)—Pachydictya.
fasciculata—Clonopora.
fastigata—Unitrypa.
fastuosa—Polypora.
favosa—Hemitrypa.
fenestelliformis—Pachydictya.
fenestelliformis-corticula—Pachydictya.
fenestrata—Phylloporina.
—Rhinidictya.
(Retepora)—Drymotrypa.
(Stictopora)—Rhinidictya.
(Sulcopora)—Rhinidictya.
(Subretepora)—Phylloporina.
fertile—Batostoma.
fertile-circulare—Batostoma.
fibrosa—Stenopora.
fibrosus—Nemataxis.
ficticia—Unitrypa.
fidelis—Rhinidictya.
filiasus—Amplexopora filiosa.
filiosa—Amplexopora.
filiformis—Fenestella.
—Hederella.
(Aulopora)—Hederella.

filistriata—Fenestella.
filitexta—Fenestella.
fimbriata—Pachydictya.
—Phænopora.
(Ptilodictya)—Phænopora.
firma—Pachydictya.
fischeri—Constellaria.
fistulata—Polypora.
—Anisotrypa.
fistulosa (Callopora)—Lioclema cellulosum.
flabellaris—Homotrypa.
flabellata—Diastoporina.
—Stictoporella.
(Chiloporella)—Chiloporella nicholsoni.
(Clathropora)—Stictoporella.
(Fistulipora)—Chiloporella nicholsoni.
flabelliformis—Polypora.
flabellum—Dichotrypa.
flagellum—Ptilodictya.
flexuosa—Pinnatopora.
—Retepora.
—Reteporina.
—Stictoporella.
(Fenestella)—Reteporina.
(Ptilodictya)—Stictoporella.
fletcheri—Dekayella ulrichi.
fletscheri—Dekayella ulrichi.
florida (Callopora)—Lioclema.
(Constellaria)—Constellaria constellata.
florida-plana—Constellaria constellata-plana.
florida-prominens—Constellaria constellata-prominens.
floridum—Lioclema.
foliacea—Fistulipora.
—Meekopora.
—Retepora.
(Ceramopora)—Meekopora.
(Lichenalia)—Fistulipora.
foliata—Dichotrypa.
—Fenestella.
—Pachydictya.
(Paleschara)—Ptilodictya nebulosa.
foliatum—Lioclema.
foordi—Fistulipora.
formosa—Nematopora.
foveolata—Strotopora.
fungia—Cyclopora.
funicula—Fenestella.
furcatus—Chætetes.
furcillatus—Thamniscus.
fusiforme—Ascodictyon.
fusiformis—Lioclemella.
(Chætetes)—Lioclemella.
(Monticulipora)—Lioclemella subfusiformis.
fustiformis—Sceptropora.
fragilis—Dicranopora.
—Helopora.
—Nematopora.
—Trematopora.
(Ptilodictya)—Dicranopora.
(Stictopora)—Dicranopora.
fragilis-acadiensis—Helopora.
frequens—Fenestella.
frondifera—Stictoporella.
frondosa—Ceramophylla.
—Clathropora.
—Heterotrypa.
—Phyllodictya.
—Proboscina.
—Tæniodictya.
(Alecto)—Proboscina.
(Aulopora)—Proboscina.
(Monticulipora)—Heterotrypa.
(Monticulipora) (Nich., J. & J.)—Peronopora decipiens.
(Rhinopora)—Rhinopora verrucosa.
(Stomatopora)—Proboscina.
frondosa-clintonensis—Clathropora.
frondosus (Chætetes)—Heterotrypa.
(Chætetes) (Nich.)—Peronopora decipiens.
frondosus limatus (Chætetes)—Heterotrypa frondosa.
fruticellus—Thamniscus.
fruticosa—Acanthocladia.
—Stictopora.
(Bythopora)—Bythopora dendrina.
(Monotrypa)—Chætetes.
fruticosus (Hamilton)—Chætetes.
(Lower Helderberg)—Monotrypella arbuscula.
furcatus—Chætetes.
gelasinosa—Homotrypa.
geniculata—Callotrypa.
—Cystopora.
(Callopora)—Callotrypa.
geometrica—Fistulipora.
gigantea—Pachydictya.
—Ptilodictya.

gigantea (Heterodictya)—Ptilodictya.
gilberti—Cystodictya.
gladiola—Ptilodictya.
glomerata—Stictopora.
—Trematella.
(Trematopora)—Trematella.
goodhuensis—Callopora.
gracilis—Bythopora.
—Clathropora.
—Phylloporina.
—Polypora.
—Rhombopora.
(Batostomella)—Bythopora.
(Chætetes)—Bythopora.
(Homotrypella)—Bythopora.
(Monticulipora)—Bythopora.
(Retepora)—Phylloporina.
(Subretepora)—Phylloporina.
gracillimum—Lioclema.
grahami—Arthropora shafferi-cleavelandi.
graminifolia—Stictopora.
granatula—Stictopora.
grandis—Archimedes.
—Dichotrypa.
—Evactinopora.
—Prasopora.
—Rhinidictya.
(Monticulipora)—Prasopora.
granifera—Fistulipora.
—Orthopora.
—Stictopora.
(Fenestella)—Semicoscinium.
(Lichenalia)—Fistulipora.
(Pileotrypa)—Fistulipora.
(Trematopora)—Orthopora.
graniferum—Semicoscinium.
granilinea—Orthopora.
—Polypora.
(Fenestella)—Polypora.
(Trematopora)—Orthopora.
granistriata—Bactropora.
—Phylloporina.
(Trematopora)—Bactropora.
granosa—Nematopora.
granosus—Cœloconus.
granulata—Trematopora.
granulifera—Batostomella.
—Homotrypella.
(Batostomella)—Homotrypella.
(Monticulipora)—Homotrypella.
granulifera (Rhombopora)—Batostomella.
(Trematopora)—Batostomella.
granuliferus (Chætetes)—Homotrypella.
granulosa—Ceramoporella.
—Dicranopora.
—Fenestella.
(Ptilodictya)—Rhinidictya.
(Rhinidictya)—Dicranopora.
granulosa-milfordensis—Ceramoporella.
gregaria—Petigopora.
halli—Fistulipora.
—Phylloporina.
—Trematopora.
halliana—Polypora.
hamiltonense—Monticulipora winchelli.
hamiltonensis—Chætetes.
—Cystodictya.
—Reteporina.
—Streblotrypa.
(Callopora)—Streblotrypa.
(Ceriopora)—Streblotrypa.
(Polypora)—Reteporina.
(Retepora)—Reteporina.
(Rhombopora)—Streblotrypa.
hamiltoniana—Polypora.
harrisi—Helopora.
(Calloporella)—Calloporella circularis.
helderbergiæ—Monotrypa.
helios—Fistulipora.
hemicycla—Semicoscinium labiatum.
hemispherica—Crepipora.
—Fistulipora.
(Callopora)—Fistulipora.
hemisphericus (Thecostegites) — Fistulipora.
hemitrypa—Hemitrypa proutana.
herrickana—Fenestella.
herricki—Bythopora.
hertzeri—Streblotrypa.
hestia—Fenestella.
heteropora—Callotrypa.
hexagona—Orthopora.
hexagonalis—Leptotrypa.
—Pachydictya.
—Polypora.
(Fenestella)—Polypora.
hexagonalis-foraminulosa—Polypora.
hilli—Escharopora.
hindei—Semicoscinium.

hirsuta—Atactopora.
hispida—Chilotrypa.
hospitalis—Prasopora.
hopitalis-lævis—Monticulipora lævis.
hospitalis-neglecta—Prasopora hospitalis.
humifusa—Hernodia.
humile—Batostoma.
humilis—Chætetes.
(Rhinidictya)—Pachydictya.
huronensis—Fistulipora.
—Stenopora.
(Ceramopora)—Fistulipora.
hyale—Cœlocaulis.
idalia—Fenestella.
idothea—Polypora.
imbricata—Ceramopora.
—Helopora.
—Polypora.
(Cœloclema)—Diamesopora.
imbricella—Ceramopora.
immersa—Orthopora.
imperfectum—Hemiphragma.
implicatum—Batostoma.
impolita—Anolotichia.
impressa—Crepipora.
—Polypora.
inæqualis—Fenestella.
—Ptiloporella.
(Fenestella)—Ptiloporella.
incerta—Monotrypa.
—Phylloporina.
—Polypora.
(Retepora)—Phylloporina.
(Subretepora)—Phylloporina.
incipiens—Phænopora.
incisurata—Cystodictya.
inclusa—Ceramoporella.
—Favicella.
(Thallostigma)—Favicella.
inclusapora—Favicella inclusa.
incompta—Monticulipora.
incongruens—Fenestella.
incontroversa—Callopora.
incrassata—Fistulipora.
—Paleschara.
—Rhombopora.
—Stictopora.
(Callopora)—Fistulipora.
(Cystodictya)—Stictopora.
incrustans—Ceramopora.
—Paleschara.
incurva—Clonopora.
indenta—Cystodictya.
inexpectans—Monotrypa helderbergiæ.
infida—Mesotrypa.
inflata—Stomatopora.
—Tuberculopora.
(Alecto)—Stomatopora.
(Hippothoa)—Stomatopora.
inflecta—Heterotrypa.
inflexum—Semicoscinium.
informis—Leptotrypa.
infraporosa—Fenestrapora.
infrequens—Diamesopora.
—Ptilopora.
(Cœloclema)—Diamesopora.
(Trematopora)—Diamesopora.
infundibuliformis—Gorgonia.
insignis—Homotrypa subramosa-insignis.
instabilis—Homotrypella.
insueta—Atactoporella.
—Berenicea.
insularis—Prasopora.
intabulata—Monotrypa.
interaspera—Fistulipora.
intercalaris—Homotrypa.
—Stenopora.
intercella—Paleschara.
intercellatum—Lioclema.
intermedia—Clathropora.
—Dichotrypa.
—Fenestella.
—Pinnatopora.
—Polypora.
intermedius—Archimedes.
intermittens—Stenopora.
internascens—Chætetes.
internodata—Callotrypa.
internodia—Dicranopora.
interplana—Orthopora.
interpolata—Tæniodictya.
interporosa—Ceramoporella.
interruptum—Semicoscinium.
interstincta—Batostomella.
(Stictoporella)—Stictoporella flexuosa.
interstriata—Stictopora.
intertexta—Clathropora.
invaginatus—Archimedes.
invertis—Cystodictya.
involvens—Lioclema.
iowensis—Spatiopora.
irrasum—Hemiphragma.
irregularis—Ceramoporella.
—Cœlocaulis.
—Helopora.
—Leptotrypa.
(Alveolites)—Ceramoporella.

irregularis (Callopora)—Cœlocaulis.
  (Ceramopora)—Batostoma implicatum.
  (Chætetes)—Leptotrypa.
  (Monotrypa)—Leptotrypa.
  (Monticulipora)—Leptotrypa.
  (Trematopora)—Orthopora.
jamesi—Batostoma.
  (Chætetes)—Batostoma.
jamesii (Cyclopora)—Escharopora pavonia.
juncea—Fenestella.
kentuckyensis—Monticulipora.
  —Ptilodictya.
keyserlingi—Glyptopora.
labecula—Ceramopora confluens.
labeculoidea—Ceramopora.
labeculosa—Spatiopora.
labiatum—Semicoscinium.
labiosa—Fistulipora.
labyrinthica—Stictopora.
læviramus—Bythopora gracilis.
lævis—Monticulipora.
lævis-consimilis—Monticulipora.
lævistriata—Polypora.
lamellata—Fistulipora.
lamellosa—Monticulipora.
laminata—Nicholsonella.
  —Lioclema.
laminatum—Lioclema.
lanceolata-americana—Ptilodictya expansa.
largior—Fenestrapora.
largissima—Polypora.
lata—Prismopora.
  —Rhinidictya.
  —Unitrypa.
  (Dicranopora)—Rhinidictya.
  (Fenestella)—Unitrypa.
laticarina—Fenestella.
laticrescens—Ptiloporella.
latijuncturum—Semicoscinium.
latispiralis—Helicopora.
latitruncata—Polypora.
latum—Coscinium.
laxa—Proboscina.
  (Archimedes)—Archimedes owenanus.
  (Fenestella)—Archimedes.
laxata—Bythotrypa.
laxum—Chainodictyon.
laxum-minor—Chainodictyon.
laxus—Archimedes.
lens—Calloporella.
lens (Fistulipora)—Calloporella.
  (Monticulipora)—Calloporella circularis.
lenticularis—Prasopora.
lepidodendroides—Rhombopora.
levinodata—Polypora.
libana—Escharopora.
  —Stenopora.
lichenoides—Ptilodictya.
  (Stromatopora)—Arthropora shafferi.
lilæa—Polypora.
limata—Cystodictya.
limbata—Fenestella.
limbatus-remotus—Fenestella remota.
limitaris—Constellaria.
  —Diplotrypa.
  —Escharopora.
  —Fenestella.
  (Stellipora)—Constellaria.
lineanoda—Fenestella.
linearis—Cystodictya.
lineata—Cystodictya.
  —Nematopora.
  —Orthopora.
  —Spatiopora.
  (Crateripora)—Escharopora falciformis.
  (Helopora)—Nematopora.
  (Phractopora)—Phractopora cristata.
  (Rhombopora)—Orthopora.
  (Trematopora)—Orthopora.
lineata-expansa (Crateripora)—Escharopora falciformis.
lineata-incepta—Spatiopora.
lineata-major—Cystodictya.
lineata-sancti-ludovici—Cystodictya.
lineinodis—Rhombopora.
lineinodis-humilis—Rhombopora.
lineopora—Nematopora.
lirata—Phænopora.
lobata—Euspilopora.
loculata—Loculipora.
lodiensis—Fenestella.
longimacula—Fistulipora.
longispina—Lichenotrypa.
lunata—Buskopora.
  (Fistulipora)—Buskopora.
  (Lichenalia)—Buskopora dentata.
lunata-tubulata—Buskopora dentata.
lunulatum—Semicoscinium.
lycoperdon—Chætetes.

lycoperdon (Prasopora)—Prasopora simulatrix.
lycoperdon-selwyni—Prasopora.
lycopodites—Favosites.
(Chætetes)—Chætetes lycoperdon.
lyelli—Fenestella.
lyra (Fenestella)—Lyropora subquadrans-lyra.
lyroides—Dichotrypa.
maccoyana—Polypora.
macropora—Callotrypa.
—Nematopora.
(Callopora)—Callotrypa.
(Trematopora)—Nematopora.
macropora-signata—Callotrypa.
macrostoma—Eridopora.
maculata—Atactopora.
—Ceramopora.
—Dekayia.
—Escharopora.
—Paleschara.
(Leptotrypa)—Paleschara.
(Monticulipora)—Dekayia.
(Ptilodictya)—Escharopora.
maculosa—Fistulipora.
—Spatiopora.
(Callopora)—Fistulipora.
(Lichenalia)—Fistulipora.
(Trematopora)—Fistulipora.
maculosa-incepta—Spatiopora lineata-incepta.
magna—Hederella.
—Monotrypa.
—Phænopora.
(Stictopora)—Phænopora.
magnifica—Fenestella.
—Ptilodictya.
magnipora—Pachydictya.
magnopora—Callopora.
magnoporum—Batostoma.
major—Streblotrypa.
mammillosa—Monticulipora molesta.
mammulata—Monticulipora.
(Monticulipora) (Nich.)—Heterotrypa frondosa.
mammulatus (Quenstedt)—Chætetes.
(Chætetes)—Monticulipora.
—Heterotrypa frondosa.
mammulata-molesta—Monticulipora molesta.
manitobense—Batostoma.
manitobensis—Polypora.
marcida—Fenestella.
marginalis—Fenestella.
marginata—Pinacotrypa.
(Polypora)—Polypora submarginata.
maxima—Ceramopora.
mediopora—Cœlocaulis
meekana—Fenestella.
—Stenopora.
meekanus—Archimedes.
meeki—Cystodictya.
—Bythopora.
—Helopora.
(Chætetes)—Bythopora.
(Homotrypella)—Bythopora.
(Monticulipora)—Bythopora.
(Ptilodictya)—Cystodictya.
megastoma—Phractopora.
membranacea—Berenicea.
mexicana—Polypora.
michelinia—Glyptopora.
(Phractopora)—Glyptopora sagenella-lata.
microporum—Lioclema.
microscopicus—Chætetes.
microtrema—Fenestella.
milfordensis—Ceramoporella granulosa-milfordensis.
milleri—Mesotrypa.
mimica—Fenestella.
minima—Leptotrypa.
—Prismopora.
—Rhinidictya.
(Eridopora)—Eridopora denticulata.
minima-modesta—Rhinidictya.
minimus (Favosites)—Monotrypa spherica.
minnesotense—Batostoma.
minnesotensis—Berenicea.
—Homotrypa.
minnesotensis-montifera—Homotrypa.
minor—Pinnatopora.
—Rhombopora.
minuta—Nematopora.
(Fistulipora)—Lioclema.
(Trematopora)—Nematopora.
minutum—Lioclema.
minutus—Bythopora delicatula.
minutissimum—Lioclema.
mirabile—Semicoscinium.
missouriensis—Lioclema punctatum.
modesta—Fenestella.
molesta—Monticulipora.

moniliformis—Heterotrypa.

—Stomatopora.

(Amplexopora)—Heterotrypa.

(Chætetes)—Heterotrypa.

(Monticulipora)—Heterotrypa.

monticula—Monticulipora.

monticulata—Fistulipora.

—Monotrypa.

monticulatus (Chætetes)—Monotrypa.

montifera—Eurydictya.

—Spatiopora.

—Stenopora.

montuosum—Batostoma.

mucronata—Helopora.

multaculeatum—Lioclema.

multifida—Phænopora.

multigranosa—Atactoporella.

multiplex—Polypora.

multipora—Eurydictya.

—Rhombopora.

(Fistulipora)—Chiloporella nicholsoni.

(Phænopora)—Eurydictya.

(Stictopora)—Cystodictya incisurata.

multiporata—Homotrypella.

—Streblotrypa.

multiporata-lodiensis—Fenestella lodiensis.

multiramis—Ptilodictya.

multiramus—Thamniscus.

multispinosa—Dekayia.

—Fenestella.

multiseriata—Callotrypa.

multitabulata—Callopora.

multituberculata—Monotrypella quadrata.

mundula—Atactoporella.

—Homotrypella.

(Atactopora)—Atactoporella.

mundulum—Mitoclema.

muscatinensis—Chætetes.

mutabilis—Eridotrypa.

—Polypora.

—Rhinidictya.

(Fenestella)—Polypora.

(Stictopora)—Rhinidictya.

mutabilis-major—Rhinidictya.

mutabilis-minor—Eridotrypa.

(Stictopora)—Rhinidictya.

mutabilis-senilis—Rhinidictya.

nana—Tropidopora.

—Unitrypa.

(Fenestella)—Unitrypa.

nanus—Thamniscus.

nashvillensis—Rhinidictya.

nebulosa—Ptilodictya.

neglecta—Diplotrypa.

—Fistulipora.

—Rhinidictya.

neglecta-canadensis—Rhinidictya.

neglecta-maculata—Fistulipora.

negligens—Archimedes.

nereidis—Pinnatopora.

nereis—Ichthyorachis.

nervata—Ptiloporella.

nervia—Unitrypa.

nervia-constricta—Unitrypa.

newberryi—Aspidopora.

newportensis—Atactoporella.

nexa—Polypora.

nexilis—Fenestella.

(Alecto)—Batostoma implicatum.

niagarensis—Drymotrypa.

nicholsoni—Chiloporella.

—Fenestella.

—Rhinidictya.

(Ceramopora)—Chiloporella.

(Monticulipora)—Chiloporella.

nicklesi—Rhombopora.

—Streblotrypa.

nitida—Cystodictya.

—Lioclemella.

(Graptodictya)—Graptodictya perelegans.

(Trematopora)—Lioclemella.

nitidula—Batostomella.

—Dicranopora.

(Ptilodictya)—Dicranopora.

nodata—Pinnatopora.

—Reptaria.

(Glauconome)—Pinnatopora.

(Ptilionella)—Reptaria.

nodocarinata—Polypora.

nododorsalis—Fenestella.

nodosa—Fenestella.

—Helopora.

—Hemitrypa.

—Monotrypa.

—Orthopora.

—Prasopora.

—Ptilodictya.

—Ptilopora.

—Trematella.

nodosa—Trematopora.
(Trematopora)—Trematella.
nodulosa—Callopora.
—Calloporella.
(Monticulipora)—Callopora.
nodulosus (Chætetes)—Callopora.
nodulifera—Fistulipora.
noe—Fenestella.
normalis—Fenestella.
—Fistulipora.
norwoodiana—Fenestella.
notha—Ceramopora.
nummiformis—Callopora.
nysa—Thamniscus.
obesa—Pachydictya.
obliqua—Eridotrypa.
—Homotrypa.
—Polypora.
—Ptilodictya.
—Rhinidictya.
—Streblotrypa.
(Stictopora) — Cystodictya incisurata.
—Ptilodictya.
obliquata—Ptilotrypa.
obliquatum—Semicoscinium lunulatum.
obliquus—Arthrostylus.
obscura—Dekayella.
obsoleta—Stictopora.
occidens—Lioclema.
occidentalis—Fenestrapora.
—Pachydictya.
—Tæniopora.
ocellata—Cystodictya.
octonarius—Thamniscus.
oculata—Prasopora.
oculifera—Callotrypa.
offula—Paleschara.
ohioensis—Ceramoporella.
—Lioclemella.
—Rhombopora.
—Stenopora.
(Callopora)—Lioclemella.
(Ceramopora)—Ceramoporella.
(Monticulipora)—Dekayella ulrichi-robusta.
onealli—Callopora.
(Monticulipora (Heterotrypa))—Callopora onealli-sigillarioides.
onealli-communis—Callopora.
onealli-sigillarioides—Callopora.
operculata—Pinacotrypa.
oppleta—Callopora.
orbiculata—Ceramopora.
orbicutata—Ceramopora.
orbipora—Orthopora.
—Stictotrypa.
(Stictopora)—Stictotrypa.
(Trematopora)—Orthopora.
ornata—Leptotrypa.
—Orthopora.
(Trematopora)—Orthopora.
—Trematopora primigenia-ornata.
ortoni—Atactoporella.
(Chætetes)—Atactoporella.
(Monticulipora)—Atactoporella.
—Monotrypa nodosa.
osculum—Diamesopora.
ostiolata—Chilotrypa.
ottawaense—Hemiphragma.
ottawaensis—Astroporites.
ottawense—Hemiphragma.
ovalis—Lyropora.
—Nematopora.
ovata—Cystodictya.
—Fistulipora.
—Homotrypella.
—Stromatotrypa.
(Lichenalia)—Fistulipora.
(Stictopora)—Cystodictya.
ovatipora—Cystodictya.
—Orthopora.
(Stictopora) (Hall)—Cystodictya.
(Miller) — Stictotrypa similis.
(Trematopora)—Orthopora.
ovatopora—Eschara.
ovatum—Acanthoclema.
owenanus—Archimedes.
oweni—Cœloclema.
paliformis—Glossotrypa.
palmipes—Euspilopora.
papillata—Monticulipora.
papillatus—Chætetes.
papillosa—Stictopora.
parallela—Fenestella.
—Orthopora.
—Ptilocella.
—Rhinidictya.
(Fenestella)—Loculipora loculata.
(Ptilodictya) (James)—Rhinidictya.
(H. & S.)—Ptilocella.

parallela (Trematopora)—Orthopora.
parasitica—Idiotrypa.
—Monticulipora.
—Sphragiopora.
(Callopora)—Lioclema and Cœlocaulis mediopora.
(Fistulipora)—Lioclema.
parasitica-plana—Monticulipora.
parasiticum—Lioclema.
parmula—Aspidopora.
parmula-fenestelliformis—Aspidopora.
parva—Constellaria.
—Dicranopora.
—Stomatopora.
(Monticulipora)—Constellaria.
parvicella—Ceramopora.
parvula—Bythopora.
parvulipora—Fenestella.
patella—Mesotrypa.
patellifera—Fenestella variapora.
pateriformis—Hemitrypa.
patula—Stenopora.
paucipora—Callotrypa.
paucirama—Prismopora.
pauciramus—Thamniscus.
paupera—Heterotrypa.
—Ptilopora.
—Rhinidictya.
(Stictopora)—Rhinidictya paupera and neglecta.
pavonia—Escharopora.
pavonica—Escharopora pavonia.
paxillata—Polypora.
peculiaris—Actinotrypa.
—Fenestella.
(Fistulipora)—Actinotrypa.
pediculata—Rhinidictya.
pelliculata—Dekayia.
penniformis—Tæniopora.
(Ptilionella)—Reptaria stolonifera.
perampla—Crepipora.
perangulata—Polypora.
perantiqua—Gorgonia.
perarcta—Cystodictya.
perelegans—Callopora.
—Fenestella.
—Graptodictya.
(Ptilodictya)—Graptodictya.
perforata—Loculipora.
permarginata—Fistulipora.
—Stictopora.
(Fenestella) — Semicoscinium.
permarginata (Lichenalia)—Fistulipora.
permarginatum—Semicoscinium.
perminimus—Archimedes.
perminuta—Fenestella.
—Strotopora.
pernodosa—Unitrypa.
perplexa—Fenestella.
persimilis—Rhombopora.
perspinulata—Trematella.
perstriata—Hemitrypa.
pertenuis—Paleschara.
—Phacelopora.
(Fenestella)—Fenestella proutana.
(Rhopalonaria)—Stomatopora delicatula.
pertollata—Reteporina.
perundata—Reteporidra.
perundulata—Reteporina.
perversa—Cycloporella.
petasiformis—Amplexopora.
petasiformis-welchi—Amplexopora.
petechialis—Petigopora.
petropolitanus—Chætetes.
(Chætetes)—Mesotrypa whiteavesi.
philia—Fenestella.
phillipsi—Reteporina.
pinnata—Phractopora.
—Ptiloporina.
—Septopora.
(Fenestella)—Ptiloporina.
(Glyptopora)—Phractopora.
(Pinnaporina)—Ptiloporina.
plana—Pinacotrypa.
planiramosa—Fenestella.
(Fenestella) (Lower Helderberg)—Polypora.
planodorsatum—Semicoscinium.
platyphylla—Phænopora expansa.
plumaria—Ptilodictya.
plumea—Stictoporina.
plumosa—Glyptopora.
—Hemitrypa.
(Fenestella)—Hemitrypa.
plumosum (Coscinium)—Glyptopora and Glyptopora sagenella-caliculosa.
polygona—Orthopora.
polymorpha—Stenopora tuberculata.
polystomella—Constellaria.
(Monticulipora)—Constellaria constellata and polystomella.
ponderosa—Anolotichia.

ponderosa—Nicholsonella.
—Ptilodictya.
(Callopora)—Lioclema.
(Fistulipora)—Lioclema.
(Fistuliporina)—Lioclema.
(Trematopora) — Fistulipora maculosa.
ponderosum—Lioclema.
ponderosus—Chætetes.
popeana—Fenestella.
porosa—Polypora.
præcursor—Unitrypa.
prænuntia—Dekayella.
prænuntia-multipora—Dekayella.
prænuntia-nævigera—Dekayella.
prænuntia-simplex—Dekayella.
prima—Rhinopora.
(Hemitrypa)—Unitrypa nervia.
primigenia—Trematopora.
primigenia-ornata—Trematopora.
primigenia-spinosa—Trematopora.
primitiva—Berenicea.
prisca—Reteporina.
—Streblotrypa.
(Cavea)—Streblotrypa.
(Fenestella)—Semicoscinium tenuiceps.
(Retepora)—Reteporina.
proceritas—Fenestella.
projecta—Unitrypa acaulis.
prolifera—Acrogenia.
prolifica—Fistulipora.
(Heterotrypa)—Heterotrypa subramosa-prolifica.
(Monticulipora) — Heterotrypa subramosa-prolifica.
prolixa—Fenestella.
proporoides (Fistulipora) — Pinacotrypa elegans.
propria (Fenestella)—Polypora.
proutana—Fenestella.
—Hemitrypa.
(Stomatopora) — Stomatopora delicatula.
proutana-nodulosa—Hemitrypa.
proutana-vermifera—Hemitrypa.
proutanus—Archimedes.
prouti—Ptilopora.
proxima—Monotrypa.
proximus (Favosites)—Monotrypa.
psyche—Polypora.
pulchella—Callopora.
—Fenestella.
—Polypora.
pulchella—Rhombopora.
pulchella-persimilis—Callopora.
pulchellum—Arthroclema.
pulchellus (Chætetes)— Callopora andrewsi.
pulchra—Nicholsonella.
pumila—Pachydictya.
pumila-sublata—Pachydictya.
punctata—Constellaria.
—Phænopora.
—Trematopora.
(Callopora)—Lioclema.
(Monticulipora)—Constellaria.
(Ptilodictya)—Phænopora.
punctatum—Lioclema.
punctifera—Eridopora.
punctillatum—Lioclema.
punctipora—Glyptopora.
—Stictotrypa.
(Stictopora)—Stictotrypa.
punctostriata—Polypora.
pustulosa—Amplexopora.
—Cystodictya.
—Fistulipora.
(Lichenalia)—Fistulipora.
(Monticulipora)—Amplexopora.
puteolata—Intrapora.
pyriformis—Buskopora.
quadrangula—Fenestella.
quadrangularis—Leptotrypa.
—Polypora.
(Chætetes) — Leptotrypa quadrangularis.
(Fenestella)—Polypora.
(Paleschara)—Leptotrypa.
quadrata—Helopora.
—Monotrypella.
(Monticulipora)—Monotrypella.
(Nematopora) — Nematopora ovalis.
quadrata-subquadrata—Monotrypella subquadrata.
quadratus (Chætetes)—Monotrypella.
quadrula—Unitrypa.
quebecensis—Mesotrypa.
quinqueradiata—Evactinopora.
quincuncialis—Lyropora.
radialis—Polypora.
—Streblotrypa.
—Vinella.
radiata—Ceramopora.
—Evactinopora.
—Lichenalia.
—Paleschara.

radiata—Scenellopora.
radiciformis-conferta—Vinella.
ramosa—Atactoporella.
—Callopora.
—Ceriopora.
—Escharopora.
—Fistulipora.
—Stenopora.
—Stictopora.
(Eschara)—Phænopora fimbriata.
(Lichenalia)—Fistulipora.
(Monticulipora)—Callopora.
(Ptilodictya)—Escharopora.
ramosa-dalei—Callopora dalei.
ramosa-rugosa—Callopora rugosa.
ramosus (Chætetes)—Callopora.
ramulosa—Anisotrypa.
—Tæniodictya.
ramulosa-burlingtonensis—Tæniodictya.
ramulosus—Thamniscus.
ramulosus-sevillensis—Thamniscus sevillensis.
ranosculum—Lyropora.
raripora—Ceramopora.
—Nematopora.
(Ptilodictya)—Nematopora.
(Stictopora)—Nematopora.
recta—Cystodictya.
—Escharopora.
—Stomatopora.
(Escharopora)—Escharopora falciformis.
(Stictopora)—Cystodictya.
recta-nodosa—Escharopora.
rectangularis (Monticulipora)—Monotrypella quadrata.
rectilatera (Stictopora)—Cystodictya.
rectilinea—Cystodictya.
—Trematopora.
rectimuralis—Monotrypa.
rectistyla—Septopora.
recubans—Tæniopora.
regalis—Fenestella.
regalis-macra—Fenestella.
regularis—Mesotrypa.
—Orthopora.
—Streblotrypa.
(Diplotrypa)—Mesotrypa.
(Rhombopora)—Orthopora.
(Trematopora)—Orthopora.
remota—Fenestella.
repens—Vinella.
reticulata—Eschara.
—Orthopora.
reticulata—Paleschara.
—Phylloporina.
(Intricaria)—Phylloporina.
(Rhombopora)—Orthopora.
(Subretepora)—Phyllopora.
(Trematopora)—Orthopora.
retiformis—Gorgonia.
(Ptilodictya)—Stictoporina.
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—Nematopora.
—Polypora.
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(Unitrypa)—Unitrypa tegulata.
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(Archimedes)—Archimedes wortheni.
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rhombicus—Cœloconus.
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(Stictopora)—Tæniodictya.
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—Pachydictya.
—Polypora.
—Septopora.
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(Ptilodictya)—Pachydictya crassa.
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LIST OF PAPERS TREATING OF BRYOZOA.

The following list includes all papers which treat exclusively of bryozoa. Works of which the bryozoa form an incidental part have been included when the bryozoa portion was deemed important. Doubtless a considerable number of papers have been overlooked, but it is hoped that the omissions will not prove serious.

For easy reference the authors' names have been arranged alphabetically, and their papers have been listed in chronological order. The dates given may not always be exactly correct, but they are probably seldom far astray. In cases where the actual date of publication is known to be considerably different from the title-page date the former is used. Titles of serials have usually been written in full in this list, but abbreviated in the second list.

In the second list the foregoing papers have been rearranged under several heads, so as to bring together those answering the needs of special workers. It has not been deemed practicable to classify except under large heads. Some errors in classification will no doubt be detected. Occasionally the titles given to their papers by authors are unintentionally misleading. A large number of papers I have been unable to examine, and many references are given on the authority of other writers.

Under the several heads the chronologic order has been adopted, as such an arrangement is very suggestive, both of the progress of knowledge and the point of view of the several authors. Under each year the authors' names are arranged alphabetically. Some works which I have not examined are included under "General;" an examination of these might show however that they would be more appropriately placed under other heads.

It is hoped that the general usefulness of the list will atone for unavoidable shortcomings. The amount of literature devoted to one comparatively small class of the animal kingdom will no doubt be surprising.

For the opportunity of consulting the libraries of Washington, District of Columbia, without which the list could not have been compiled, I have to thank the Hon. Charles D. Walcott, Director of the United States Geological Survey. Some members of the staff of the United States National Museum, and especially Mr. Charles Schuchert, have given valued help.

JOHN M. NICKLES.

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1857. On a new species of Bugula. (Quarterly Journal of Microscopical Science, V, 1857, pp. 174–175, pl. xvii.)

1857. A catalogue of the Zoophytes of Northumberland and Durham. (Transactions of the Tyneside Naturalists' Field Club, III, 1858 [1857], pp. 93–162, pls. iii–x; Bryozoa on pls. vii, viii, x.)

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THE FOREGOING LIST CLASSIFIED.

HEADS OF CLASSIFICATION.

A. Bibliographic—including annual reviews and lists of papers dealing with Bryozoa.
B. General—including works which treat of the Bryozoa as a whole or are too general in scope to come under more particular heads.
C. Biological—including papers concerned mainly with anatomy, morphology, embryology, development, etc.
D. Fresh-water—including papers which treat of fresh-water Bryozoa biologically and systematically.
E. Marine—including papers which treat of living marine Bryozoa mainly from a systematic standpoint.
F. Tertiary and Quaternary.
G. Mesozoic.
H. Paleozoic.

A. BIBLIOGRAPHIC.

INCLUDING ANNUAL REVIEWS AND LISTS OF PAPERS DEALING WITH BRYOZOA.

(*a*) ANNUAL REVIEWS.

[The annual reviews are generally accompanied by a list of the publications that have appeared during the period covered by the review.]

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Bibliographia Zoologica (diario "Zoologischer Anzeiger" adnexa), adjuvante concilio bibliographico quod Turici præside H. H. Field institutum est, edidit J. Victor Carus. Vols. I– , 1896– . Consult index of each volume.

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This is the "card system" applied to a current record of publications relating to zoology and several kindred branches. The titles are classified and numbered according to the Dewey decimal classification. Recent Bryozoa are 594.7; fossil Bryozoa 564.7.

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> "Multum adhuc restat operis, multumque restabit, nec ulli nato post mille sæcula præcludetur occasio aliquid adjiciendi."
>
> —Seneca.

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DEPARTMENT OF THE INTERIOR

BULLETIN

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UNITED STATES

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UNITED STATES GEOLOGICAL SURVEY
CHARLES D. WALCOTT, DIRECTOR

SURVEY

OF THE

NORTHWESTERN BOUNDARY OF THE UNITED STATES

1857-1861

BY

MARCUS BAKER

WASHINGTON
GOVERNMENT PRINTING OFFICE
1900

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LETTER OF TRANSMITTAL.

DEPARTMENT OF THE INTERIOR,
UNITED STATES GEOLOGICAL SURVEY,
Washington, D. C., June 9, 1900.

SIR: I have the honor to transmit herewith, for publication as a bulletin, an account of the establishment of and survey of the boundary line between the United States and Canada, along the forty-ninth parallel, from the summit of the Rocky Mountains to the Pacific.

Very respectfully,

MARCUS BAKER, *Cartographer.*

Hon. CHARLES D. WALCOTT,
Director United States Geological Survey.

SURVEY OF THE NORTHWESTERN BOUNDARY OF THE UNITED STATES, 1857-1861.

By **Marcus Baker.**

INTRODUCTION.

By the Northwestern Boundary, as here used, is meant that part of the boundary line between the United States and Canada which extends from the summit of the Rocky Mountains westward along the forty-ninth parallel to the seacoast at Point Roberts and thence through the waters of Georgia, Haro, and Juan de Fuca straits to the Pacific. This line naturally divides itself into two parts, the land boundary and the water boundary. This paper treats only of the land boundary. As to the water boundary, the joint commission charged with the survey disagreed, and its location was finally determined by arbitration in 1871, the arbiter, Emperor William I, of Germany, deciding in favor of the American claim. The prominence given this part of the line, growing out of the arbitration, has made its history well known. In regard to it there is an abundance of printed material. The history of the land boundary, however, is very imperfectly known. Little has been published respecting it, and its story is to be gathered largely from manuscript memoranda, notes, sketches, pictures, correspondence, and the memories of men still living.

From time to time information respecting this line is needed by the Executive Departments. In 1897 the Geological Survey was directed by Congress to survey and mark the boundary between Montana and Idaho. In performing this duty it became necessary to connect with the survey of the forty-ninth parallel. The search then made of the records in the State Department showed the desirability of preparing a concise history of the northwestern boundary, its establishment, survey, and marking, with a summary of results. To exhibit such a history and summary is the object of this bulletin.

SOURCES OF INFORMATION.

The sources of information from which this account is prepared are three, viz:

(a) Government publications, consisting of the Statutes at Large, executive documents, official reports, etc.

(b) Manuscript records in the State Department, consisting of the original notebooks, observations, computations, plattings, sketches, maps, correspondence, etc.

(c) The memories of some of the surviving participants in the survey. These will be discussed in the order indicated above.

(a) In the Statutes at Large are contained all laws enacted by Congress touching the boundary, including also all the treaties. For the original treaty of June 15, 1846, see vol. 9, pages 869–870; for the act creating the commission to survey and mark the boundary, vol. 11, page, 42; for various appropriation acts, vol. 11, pages 42, 159, 312, 403, and vol. 12, page 20.

On November 12, 1859, Lieut. (now Gen.) John G. Parke, chief astronomer and surveyor, made a short report of progress. This is a document of 7 pages and is printed as Senate Ex. Doc. No. 16, Thirty-sixth Congress, first session. It is here reprinted as Appendix B.

Nothing further, in official documents, appears for nine years. The civil war turned attention to more urgent matters and this subject was dropped. In February, 1868, however, President Johnson sent to the Senate a long communication on the San Juan boundary question. This document (Senate Ex. Doc. No. 29, Fortieth Congress, second session) of 280 pages, though dealing chiefly with the water boundary, nevertheless throws considerable light on the history of the land boundary.

On January 13, 1869, the House of Representatives, by a resolution, requested information as to expenditures by the Northwestern Boundary Commission. In response, a message from President Johnson was laid before the House of Representatives on February 13, 1869. (House Ex. Doc. No. 86, Fortieth Congress, third session.) This document of 102 pages is almost wholly given to a detailed tabular exhibit of expenditures. There is, however, a letter of 4 pages from the commissioner, Hon. Archibald Campbell, summarizing the entire history of the survey. This is apparently the nearest approach to a report on this subject that has ever appeared in print.

Finally, in 1889, Capt. George M. Wheeler, U. S. A., published in his report upon geographical surveys west of the one hundredth meridian (vol. 1, pp. 614–619) a short account of the Survey of the Northwestern Boundary of the United States 1857–1861.

(b) The manuscript records of the survey are nearly all contained in two blue chests stored in the division of manuscripts in the library of the State Department. Some of the maps being too large to go into these chests are kept elsewhere in the library. The memoranda, notes, correspondence, maps, etc., in this collection are the chief source of information from which this account has been prepared. But unfortunately the most important document of all was not found there, and a diligent search has failed to bring it to light. This paper is the final report, written on foolscap paper and consisting of four parts, one by

Archibald Campbell, the commissioner; one by Gen. J. G. Parke, chief astronomer and surveyor; one by G. Clinton Gardner, assistant astronomer and surveyor, and one by J. S. Harris, general assistant. For this description of the missing manuscript I am indebted to Mr. William J. Warren, Bureau of Engineers, War Department. When Captain Wheeler was preparing his account of this survey he made an unsuccessful search for this missing report. He says:[1]

> I have been unable to trace the manuscript of the final report, including that of the chief astronomer and the specialists, which it is believed was made. According to the Journal of the Senate of February 9, 1871, this report was called for by the Senate, but a search of the Senate records and also those of the State Department, made at my request by Mr. Dwight, librarian of the State Department, remained unavailing on June 15, 1887. Mr. William J. Warren, secretary of the commissioner [and] now chief clerk [in the office] of the [Chief of] Engineer[s] [War] Department, recollects to have seen the manuscript of this report at the office of the Northern Boundary [Survey], established in 1873, as does also Maj. J. F. Gregory, Corps of Engineers, a member of that commission, but it could not be found by Mr. Dwight in the records transmitted at the close of the latter survey to the State Department.

The search above mentioned I have now repeated and with like result. The manuscript has not been found.

The existence of the manuscript is attested by Mr. Warren, who gave me the description above written. The call for it made by the Senate in 1871 is set forth in the following extract from the Senate Journal of February 9, 1871, page 254:

> Mr. Howard [Jacob M., of Michigan] submitted the following resolution, which was considered by unanimous consent, and agreed to:
>
> "*Resolved*, That the President be respectfully requested, if not incompatible with the public interests, to transmit to the Senate copies of the final report, and the accompanying documents, of the commissioner on the part of the United States to carry into effect the first article of the treaty with Great Britain of June 15, 1846."

An examination of the records in the office of the Secretary of the Senate reveals no other entry concerning it, from which it is concluded that it was never sent. Similarly an examination of the records in the Index Bureau of the State Department shows the call, but no action is indorsed thereon, thus corroborating the belief that it was not sent.

When the *Northern* Boundary Commission was created, in 1872, Mr. Archibald Campbell was appointed United States commissioner of *that* survey also. He found at the outset that it was desirable to have for reference the records of the *Northwestern* Boundary Survey, and accordingly wrote to the State Department asking permission to withdraw those records for temporary use.

The following is a copy of his letter, which is now on file in the Index Bureau of the State Department:

> U. S. NORTHERN BOUNDARY COMMISSION,
> *Washington, D. C., June 27, 1872.*
>
> SIR: In preparing for the duties of the boundary commission it would be of the greatest assistance to have the use of the records, notebooks, and other papers of

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[1] G. M. Wheeler, U. S. Geog. Surv. W. One Hundredth Mer. 4°. Washington, 1889, vol. 1, p. 617.

the Northwest Boundary Commission, deposited by me in the Department at the close of the work in October, 1869.

I have therefore the honor to request that you allow me to withdraw these records and papers temporarily. Before leaving for the field they will be returned to the Department.

I have the honor to be, very respectfully, your obedient servant,

ARCHIBALD CAMPBELL,
Commissioner, Northern Boundary Survey.

Hon. CHAS. HALE,
Acting Secretary of State.

Upon that letter is indorsed: "Papers, etc., herein referred to sent to Mr. Campbell 27th June."

A search of the records of the Index Bureau of the State Department fails to reveal any other entry touching these papers. If they were returned no record was made of such return. It is certain that these papers were in the possession of the Northern Boundary Commission in 1872. Beyond that there is no trace. It would therefore be natural to look for them among the papers of the Northern Boundary Commission, which were sent to the State Department on June 30, 1876. But a search among these papers made by me in March, 1900, was unsuccessful. The missing manuscript was not found.

Prof. C. L. Doolittle, now at the Flower Observatory at Upper Darby, Pennsylvania, was connected with the Northern Boundary Survey. In response to an inquiry as to whether he had any information touching the report desired, he writes, among other things, under date of March 12, 1900:

> My connection with the northern boundary began after active operations had been going on for a year. We then had our office at Detroit. After field operations were completed we removed to Washington. It is not a great exaggeration to say that I saw every scrap of paper to be found in the Detroit office. At all events, this report was not to be found there. I remember hearing such a report spoken of, but it was then said to be stored away with other Government archives at Washington.

(c) Archibald Campbell, the commissioner, died in the city of Washington July 27, 1887. To his son, Charles Campbell, now an employee in the Department of State, I am indebted for information as to the survey. I have also conferred with Gen. J. G. Parke, Corps of Engineers, U. S. A. (retired), who was chief astronomer and surveyor of the Northwestern Boundary Survey Commission, and with Mr. William J. Warren, chief clerk in the office of the Chief of Engineers, U. S. A., who was secretary of the commission. To both of these gentlemen, and especially to the latter, I am indebted for information used in preparing this account. Mr. G. Clinton Gardner, the assistant astronomer and surveyor from 1857 to 1868, is now a civil engineer in Peru, South America, while Mr. Joseph S. Harris, general assistant Northwest Boundary Survey from 1857 to 1864, is now president of the Philadelphia and Reading Railroad. To both of these gentlemen I am indebted for letters relating to the boundary and its survey. I have also talked on this subject with Mr. J. V. Wurdemann, now employed in the Library of Congress, who participated in the survey and with Dr. Theodore Gill, who prepared a report on the fishes collected by the survey. To the courtesy of these gentlemen as also to that of Prof. C. L. Doolittle, to the Smithsonian Institution, to the Coast Survey, and to the General Land Office I am indebted for bits of information used in preparing this report.

ESTABLISHMENT OF THE LINE.

The present boundary line between British Columbia on the north and Washington, Idaho, and Montana on the south was established in 1846. Prior to that date the boundary was in dispute between the United States and Great Britain and the Oregon question was a burning one. Great Britain claimed as far south as forty-two degrees north latitude, the northern limit of California to-day. The United States claimed as far north as 54° 40′, the present southern boundary of Alaska. The slogan of the day was "Fifty-four forty or fight." But there was no fight and no fifty-four forty. A treaty was arranged by which the disputed tract was divided between the claimants. The boundary line adopted was the present line along the forty-ninth parallel from the summit of the Rocky Mountains to the middle of the channel between Vancouver Island and the continent and thence southward along the main channel and Juan de Fuca Strait to the Pacific.

The diplomatic agents who drew this treaty were, on the part of the United States, James Buchanan, then Secretary of State, and on the part of Great Britain, the then British minister, Richard Pakenham. The treaty was signed at Washington June 15, 1846, ratifications exchanged at London July 17, and proclaimed August 5, 1846.[1]

The first article of the treaty describes the boundary in the following words:

> From the point on the 49th parallel of north latitude, where the boundary laid down in existing treaties and conventions between the United States and Great Britain terminates, the line of boundary between the Territories of the United States and those of Her Britannic Majesty shall be continued westward along the said 49th parallel of north latitude, to the middle of the channel which separates the continent from Vancouver's Island and thence southerly through the middle of the said channel, and of Fuca's [Juan de Fuca] Straits, to the Pacific Ocean.

HISTORY OF THE SURVEY.

On August 11, 1856, almost exactly ten years after the proclaiming of the treaty of limits, which for brevity may be called the Buchanan-Pakenham treaty, Congress passed an act to carry its first article into effect. This act provided for the appointment of a commissioner and a chief astronomer and surveyor on the part of the United States to unite with similar officers to be appointed by Great Britain to survey the boundary and mark it with monuments. It also provided for the appointment of an assistant astronomer and surveyor, a secretary, and a clerk; it appropriated $11,000 for the annual salary of these five officers, and $60,000 for provisions, transportation, and contingencies; it restricted the work to the northern boundary of Washington, which then extended from the Rocky Mountains to the Pacific; and finally it authorized the President to direct the employment of such officers, assistants, and vessels of the Coast Survey as he might deem necessary or useful.

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[1] Stat. L., vol. 9, pp. 869-870; vol. 11, p. 42.

Under this law Mr. Archibald Campbell was appointed commissioner on February 14, 1857, and on the same day Lieut. (now Gen.) John G. Parke, Corps of Engineers, U. S. A., was appointed chief astronomer and surveyor,[1] each at a salary of $3,000 per annum. Two weeks later, viz, February 28, 1857, Mr. G. Clinton Gardner was appointed assistant astronomer and surveyor, and on April 5 entered upon his duties. On April 9 Mr. William J. Warren (now chief clerk Office of Chief of Engineers, U. S. A.) was appointed secretary, and on March 6 Mr. John J. Major was appointed clerk to the commissioner. Mr. Campbell remained commissioner to the end in 1869. On the outbreak of the civil war, in the spring of 1861, General Parke left the work and never returned to it. Messrs. Gardner and Warren served with the commission until December 31, 1868, and perhaps a little later.[2] Mr. Major resigned December 9, 1864.

Of the other principal employees, Mr. Joseph S. Harris, now president of the Philadelphia and Reading Railroad, is recorded as assistant surgeon and naturalist March 27, 1857, to March 31, 1864, when he left the survey to engage in private business. Francis Herbst and Henry Custer served as topographers, the former about two years from April 16, 1857, till March 31, 1859, the latter about seven years from April 16, 1857, till June 30, 1864. Mr. J. Nevine King served as quartermaster and commissary from May 21, 1857, to January 15, 1861; Mr. George Gibbs as geologist and interpreter from June 22, 1857, till May 31, 1862, and Mr. R. V. Peabody as guide from August 1, 1857, to January 15, 1861. Dr. C. B. R. Kennerly served as surgeon and naturalist from March 22, 1857, till his death in 1861.

On February 28, 1857, Mr. Campbell received his instructions from the Secretary of State, dated February 25, whereupon, he says, "I proceeded at once to collect all such information within my reach which might contribute to a proper understanding of the meaning of the language of the treaty, and in the execution of the work intrusted to me.[3] Having arranged with Professor Bache, Superintendent of the Coast Survey, for the use of the surveying steamer *Active* and the brig

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[1] House Ex. Doc. No. 86, Fortieth Congress, Third session, p. 100.

[2] House Ex. Doc. No. 86, Fortieth Congress, Third session, p. 23.

[3] Senate Ex. Doc., No. 29, Fortieth Congress, second session, p. 8.

Fauntleroy, with the officers and assistants attached,[1] Mr. Campbell sailed from New York April 20 and reached San Francisco via the Isthmus of Panama on May 15. On June 17 the party sailed on the *Active* for Victoria, where they arrived five days later and learned that the first British commissioner, Capt. James Charles Prevost, R. N., commanding H. B. M. S. *Satellite*, had arrived at Esquimalt ten days before. The second British commissioner was Capt. George Henry Richards, R. N., whose ordinary duties were those of chief astronomer and surveyor, he being empowered to act as commissioner only in the event of the death of Captain Prevost. Captain Richards, commanding the British steamer *Plumper*, left England at the close of March, 1857, for Victoria. By an accident to the *Plumper's* machinery he was delayed at Rio de Janeiro for some time and did not reach Victoria till November, 1857. The powers of these first and second British commissioners did not extend to the whole line, but only to the water boundary. "So much of the boundary between her Majesty's possessions in North America and the territories of the United States as is comprised between the continent of America and Vancouver's Island." Such is the language of the instructions to Captain Prevost.

The British and American commissioners held their first meeting on Saturday, June 27, 1857, on board the *Satellite* in Esquimalt harbor. The respective commissions of themselves and assistants were exhibited, read, and found in due form. A second meeting was held three weeks later in Nanaimo harbor on board the *Satellite*. Captain Richards not yet having arrived, it was decided that nothing further could be done with the water-boundary question.

Accordingly the American party proceeded to the vicinity of the forty-ninth parallel at Point Roberts on the mainland and began operations on the land boundary. It was not till the summer of the next year, 1858, that the British commissioner for surveying the land boundary, Col. J. S. Hawkins, Royal Engineers, arrived from England. The American parties worked, therefore, alone during the fall and winter of 1857 and spring of 1858. "Before the spring [of 1858] four astronomical points on the 49th parallel were determined, and the country thoroughly reconnoitered in the vicinity of the parallel, for a considerable distance eastward."[2]

After the arrival of Colonel Hawkins a joint meeting of the commission was held to arrange a plan of field operations for surveying and marking the line. The outcome of that meeting is set forth in the following agreement:[2]

> After discussing plans for determining and marking the line as far eastward as the Cascade Mountains, it was concluded to be inexpedient at the present time, in con-

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[1] From Coast Survey Report for 1857, p. 116, we learn that, "At request of State Department," steamer *Active* and party, in charge of Lieut. Commander Richard M. Cuyler, U. S. N., were placed at disposal of Archibald Campbell, esq., commissioner of the Northwestern Boundary Survey.

[2] House Ex. Doc. No. 86, Fortieth Congress, Third session, p. 95.

sequence of the great expense, consumption of time, and the impracticable nature of the country, to mark the whole boundary by cutting a track through the dense forest.

It was therefore agreed to ascertain points on the line by the determination of astronomical points at convenient intervals on or near the boundary, and to mark such astronomical stations or points fixed on the parallel forming the boundary by cutting a track of not less than 20 feet in width on each side for the distance of half a mile or more, according to circumstances. Further, that the boundary be determined and similarly marked where it crosses streams of any size, permanent trails, or any striking natural feature of the country.

In the vicinity of settlements on or near the line it is deemed advisable to cut the track for a greater distance and to mark it in a manner to be determined hereafter.

This arrangement for the part west of the Cascades appears to have been subsequently applied to the whole line; and thus it resulted that of the entire boundary, 409.5 miles long, from the boundary station on the crest of the Rocky Mountains westward to the obelisk on the western side of Point Roberts, 190 miles were cleared and marked and 220 miles were not traced out, cleared, surveyed, or marked. These figures are obtained by scaling off from the final maps.

At the end of the season of 1858 the line had been reconnoitered eastward as far as the valley of the Skagit, near the one hundred and twenty-first meridian, a distance of about 90 miles, and the astronomical observations necessary for determining three points on the parallel in the valley of the Chiloweyuck completed.

In the season of 1859 the work of surveying and marking the boundary was carried eastward from the valley of the Skagit to the Columbia River, a distance of about 150 miles. General Parke, writing November 12, 1859, thus summarizes the work done during the season:

A completion of the determination and marking of the parallel from three points astronomically fixed at the close of the last season.

A complete set of observations for latitude at four stations, from which the parallel has been determined and marked at the crossings of the following streams: The Skagit, Pasayten, Similkameen, Okinakane (Lake Osoyoos), and Nehoialpitkwu; and before the astronomical parties leave the field the necessary observations will be completed for determining two other points of the parallel, the third crossing of the Nehoialpitkwu and the Columbia River.

A chronometer trip for difference of longitude between Camp Simiahmoo and Chiloweyuck depot.

Observations of the transit of the moon and moon-culminating stars at two of the latitude stations for absolute longitude.

A triangulation covering an area of about 50 square miles.

A survey of the nearest practical lines to the parallel, connecting the astronomical stations, making a total distance chained of about 370 miles.

Reconnoissances for developing the topography along and adjacent to the boundary line, and for locating routes of communication. These reconnoissances have extended over an area of about 6,000 square miles.

A full set of magnetic observations were made at one station, and throughout the work all the necessary observations for time, azimuth, micrometer value, and instrumental corrections were carefully made.

In the season of 1860 the surveying and marking of the entire land boundary was nearly or quite completed. I have not found any statement as to just when the field work ended. The Auditor's accounts indicate that a considerable number of laborers, axmen, packers, etc., were employed during 1861, of whom 22 were discharged on March 31 and 14 on June 30. Others received their final pay at various dates in 1861, the latest being in September. General Parke, who came out with the last party, tells me that on reaching the Columbia Plains he heard of the first battle of Bull Run. It seems to me likely, therefore, that the field work closed late in 1860 or early in 1861. During this season, then, the surveying and marking of the line was carried on over a distance of 170 miles—between the summit of the Rocky Mountains and the Columbia River.

As to the disbanding of the field parties and their return to Washington we gather some facts from the Auditor's accounts, so often cited here. It appears that all returned via the Isthmus of Panama, the fare being $258 from San Francisco to New York and $7.50 from New York to Washington. Commissioner Campbell, Secretary Warren, Geologist Gibbs, and Artist Alden left the field November 25, 1860, and reached Washington January 10, 1861, the journey taking forty-six days. Henry Custer, Charles T. Gardner, T. Hudson, and James Nooney left the field April 30, 1861, and G. Clinton Gardner on May 10, 1861. All these came direct to Washington. Finally, in the last quarter of 1861 (exact date not given), General Parke, J. S. Harris, J. V. Wurdemann, and John J. Major returned to Washington. With these returning parties came instruments, records, collections, baggage, etc. There is a charge for freight on "41 packages instruments and baggage" and "24 boxes natural-history specimens."

Arrived in Washington, the commission rented rooms and established an office over a store at the SE. corner of Pennsylvania avenue and Twentieth street NW., and there proceeded with the plattings, computations, drawing of maps, and preparation of the final report. The scientific reports appear to have been completed in 1862 and the drawing of the final maps, at least of the land boundary, late in 1865 or early in 1866. The work upon the report, however, continued, and there began to be some good-natured raillery as to when it would be completed. Finally, on January 13, 1869, the House of Representatives, by a resolution, requested information as to expenditures on account of the Northwestern Boundary Survey. The reply to that request has furnished the chief source of information for this history.[1] In October, 1869, the work was brought to a close and the results deposited in the State Department. But the report, unfortunately, was not published, and the manuscript has for many years been lost to view. Its whereabouts are still unknown. The reason it was not published, I am informed, is that Mr. Fish, Secretary of State at that time, deemed its publication too expensive. The war had brought a mountain of debt, and under these conditions he refused to sanction so costly a publication.

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[1] House Ex. Doc. No. 86, Fortieth Congress, third session.

COST.

The total cost of surveying and marking the line, including all expenses, was about $600,000, or $1,463 per mile. The first appropriation for the work, made August 11, 1856, was $71,000. This and the subsequent appropriations are as follows:

Appropriations for surveying and marking the boundary along the forty-ninth parallel, between the United States and the British Possessions, from the Rocky Mountains to the Pacific Ocean.

Date.	Fixed salaries.	Other expenses.	Total.	Authority.
August 11, 1856	$11,000	$60,000	$71,000	Stat. L., vol. 11, p. 42.
February 7, 1857	11,000	60,000	71,000	Stat. L., vol. 11, pp. 159-160.
June 5, 1858	11,000	60,000	71,000	Stat. L., vol. 11, p. 312.
March 3, 1859	11,000	139,000	150,000	Stat. L., vol. 11, pp. 403-404.
May 26, 1860	11,000	139,000	150,000	Stat. L., vol. 12, pp. 20-21.
Total	55,000	458,000	513,000	

The amount actually expended somewhat exceeded this sum, aggregating nearly $600,000.

In response to the House resolution of January 13, 1869, above referred to, Mr. Seward, then Secretary of State, transmitted, on February 9, 1869, a detailed reply, consisting, in the main, of a statement by Mr. C. M. Walker, then Fifth Auditor of the Treasury Department, of "disbursements on account of Northwest Boundary Survey from February 14, 1857, to December 31, 1868."[1] The total expenditures in that period were for—

Salaries	$385,508.78
Contingent expenses	209,724.25
Total	595,233.03

Most of these were made in the five years 1857 to 1861, inclusive. After the latter year a small office was maintained in Washington at an annual rental of $250, which, with various minor items, entailed an annual expense of from $1,200 to $1,400. The work was finally closed up and the records deposited in the State Department in October, 1869.[2]

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[1] House Ex. Doc. No. 86, Fortieth Congress, third session, 102 pp.

[2] Letter from Archibald Campbell to Acting Secretary of State, June 27, 1872.

For the preparation of scientific reports on magnetics, mammals, birds, fishes, plants, insects, fossils, etc., including the making of drawings, there was expended about $3,500[1] and for the drawing of the final maps about $9,400.

For building the initial monument at Point Roberts was paid $7,590.38, one-half of which was paid by the United States and one-half by Great Britain.[2]

The cost to the British Government of running and marking the boundary line I have not found. A single item bearing on the matter is contained in Parliamentary Papers, 1863, volume 37, page 287 (55–v), where there is "An estimate of the sum required to be voted in the year ending March 31, 1864, to complete the expenses of surveying the line of boundary between the British and United States territory in the western part of North America, 4,300 pounds."

While the boundary survey was going forward there was another independent exploration by the British in progress in the region, under the direction of Capt. John Palliser. Early in 1857 the president of the Royal Geographical Society recommended to the British foreign office that a grant of £5,000 be voted to cover the expense of two years' exploration along the forty-ninth and fifty-third parallels and between the one hundredth and one hundred and fifteenth meridians.[3] This sum was voted and later on £1,500 additional, to continue the work one year more, making three years in all. Among the estimates for the year ending March 31, 1861, is an item of £6,300 for completing Palliser's explorations. The results of Palliser's work, his route of travel, etc., are set forth in the Journal of the Royal Geographical Society of London, 1859, volume 29, pages xcvii–c; and 1860, volume 30, pages 267–314.

MAPS.

ORIGINAL MANUSCRIPT MAPS.

Two large blue chests in the manuscript room at the State Department contain the original observations, computations, sketches, notes, etc., relating to the Northwestern Boundary Survey. They do not contain the final maps, these being kept among the treaty maps. They do, however, contain the following manuscript map material, which may be classified as preliminary and final:

Preliminary.—First. Several rolls of rough sketches of reconnoissances, triangulation, trails, office plattings, field sketches, etc., on rough paper, drawing paper, tracing linen, and tracing paper. Some of this is original field material identified by title, date, and signature. Much of it, however, is of the nature of office studies, plattings, etc., which served a temporary purpose and is no longer of value.

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[1] House Ex. Doc. No. 86, Fortieth Congress, third session, p. 101.

[2] Same, p. 97.

[3] Parliamentary Papers, 1857, vol. 26, p. 29 (38–vii–sess. 2).

Second. There is a series of 19 sheets on tracing linen covering the entire line from the sea coast eastward to the Rocky Mountains. These sheets are numbered from west to east, 1 to 19. Each sheet except the first embraces 30′ of longitude and from 15′ to 25′ of latitude. Sheet 2, for example, includes from 123° to 122° 30′; sheet 3, longitude 122° 30′ to 122°, while sheet 19, the easternmost of the series, includes longitude 114° 30′ to 114°. The relief is shown by broken horizontal curves. The scale is not stated, but the parallels and meridians enable us to infer that it is 1: 64000, or about 1 mile to 1 inch. These sheets bear no title, no legend, no date, and no names.

Third. There is a series of five manuscript maps (not numbered) on a scale of 1:120000, showing the entire line from the sea coast to the Rocky Mountains. They appear to be unfinished drafts. Relief is shown by contours in green, trails in red, and there are a few names. They are drawn on backed drawing paper. None of them have legends or titles, or names of draftsmen or any authority. They contain no dates. They appear to be compilations from original sketches, notes, and surveys. They are not numbered. Beginning at the west end of the line, the sheets cover the following areas: The first sheet covers from latitude 48° 40′ to 49° 25′, and from longitude 123° 20′ to 120° 50′, being 30 inches high and 61 inches wide. The second sheet covers from latitude 48° 33′ to 49° 35′, and from longitude 121° 15′ to 119° 12′, being 38 inches high and 50 inches wide. The third sheet covers from latitude 48° 30′ to 49° 18′, and from longitude 119° 35′ to 117° 40′, being 29 inches high and 50 inches wide. The fourth sheet covers from latitude 47° 35′ to 49° 10′, and from longitude 117° 50′ to 114° 40′, being 59 inches high and 55 inches wide. Owing to its inconvenient size this sheet has been cut into two pieces along the parallel of 48° 21′. The meridians are erroneously numbered. The fifth sheet covers from latitude 48° 15′ to 49° 35′, and from longitude 116° 08′ to 113° 13′, being 50 inches high and 71 inches wide. This map also has been cut into two pieces along the meridian of 114° 55′. Like the preceding, the meridians are erroneously numbered. Owing to its size, this roll of maps is not kept with the other material in the chests above mentioned.

Fourth. There is an unfinished manuscript map, in two sheets, on unmounted drawing paper, covering the entire line from the sea coast to the Rocky Mountains. It includes latitude 47° to 50° and longitude 113° 30′ to 125°, is on the conic projection, and is projected on the one hundred and nineteenth as the central meridian. The eastern part includes longitude 113° 30′ to 119°, the western 119° to 125°. The scale is not stated, but appears to be 1 : 601000. There is no title, no date, no signature. It is an outline map, no relief being shown. The camps are shown, but the boundary monuments are not.

Fifth. The foregoing four groups I have called preliminary maps. There is, however, a fifth group, a set of seven tracings, which have an official character which places them in a different category. These seven tracings, on tracing linen, are on a scale of 1:120000, are numbered from west eastward, and each sheet includes 1° 20′ of longitude and 30′ of latitude, being 15′ on each side of the forty-ninth parallel. Sheet 1, the westernmost, includes longitude 123° 10′ to 121° 50′; sheet 2, 121° 50′ to 120° 30′, and so on; and sheet 7, the easternmost, 115° 10′ to 113° 50′. On these maps are shown trails, camps, caches, monuments, and names; the relief also is shown by red contour lines.

Sheet 1 has the following legend:

> Tracings numbering from 1 to 7, showing the topography, names, and scales adopted by the British and United States Boundary Commissions for their final maps. By order of the commissioners.
>
> R. W. HAIG,
> *Capt'n R'l Art'y, Astr. British Commis'n.*
> G. CLINTON GARDNER,
> *Ass't Astr. and Surv., U. S. B. C.*
>
> WASHINGTON CITY, *May 30, 1863.*

Final drawings.—The final original manuscript maps resulting from the survey are thirteen in number. To this should be added the title page, making fourteen drawings. They are beautifully drawn on "smooth antiquarian" drawing paper, backed with muslin, and bound with blue braid. The sheets are of uniform size, being 30 inches high and 42 inches wide. They are kept among the treaty maps in the library of the Department of State. They are drawn wholly in black and show trails, timber, camps, monuments, etc. Topography is shown by hachures. The scale of the ten detailed maps is 1:120000, or 1.89 miles to 1 inch; of the two general maps 1:720000, or 11.37 miles to 1 inch, and of the index map 1:1200000, or 18.94 miles to 1 inch. This series of drawings was obviously planned to form an atlas. Of this the contents would be:

1. Title.
2. Index map showing location of ten detailed sheets.[1]
3. General map, eastern section.
4. General map, western section.
5. Detailed sheets numbered 1 to 7 (from east to west), showing land boundary.
6. Detailed sheets numbered 8 to 10, showing water boundary.

The title is as follows:

> Maps of the Boundary between the United States and the British Possessions as established by the treaty of Washington, June 15, 1846. Surveyed under the direction of the Joint Commission appointed to carry into effect the First Article of the Treaty.

The index map is entitled:

> Index Map showing the limits of the detailed sheets of the U. S. North Western Boundary Survey.

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[1] The plate which accompanies this bulletin is a copy, on a reduced scale, of this map.

The general map (western section) has outside the border the legend "U. S. North West Boundary Survey, Archibald Campbell, U. S. Commissioner; John G. Parke, U. S. Eng., Chief Astr. and Surveyor." The title is as follows:

> Map of Western Section. From notes by John G. Parke, U. S. Engineers, Chief Astr. and Surveyor, G. Clinton Gardner, Ass't Astr. and Surveyor, and Jas. S. Harris, Henry Custer, Chas. T. Gardner, George Gibbs, Francis Hudson and R. V. Peabody, Ass'ts U. S. Boundary Survey.
>
> Compiled and drawn by Lemuel D. Williams, Theodor Kolecki, and Edward Freyhold. By order of U. S. Commissioner. (Signed) G. Clinton Gardner, Ass't Astr. and Surveyor, U. S. Boundary Survey, Office Washington D. C. 1866. Scale 1:720000 or 11.37 miles to one inch.

This map includes from longitude 118° to 125,° and the eastern section, bearing a similar title, includes from longitude 110° to 118°.[1]

The detailed sheets showing the land boundary, numbered 1 to 7, are signed "Jno. G. Parke, Major of Engrs., Brevet Major General, U. S. A., Chief Astr. and Surv. Archibald Campbell, U. S. Commissioner, etc. etc. etc. and J. S. Hawkins, Colonel R'l Eng'rs., H. B. M. Commissioner." The date of signing is recorded as May 7, 1869.

The detailed sheets showing the water boundary, numbered 8 to 10, have no titles, but each has the following written upon it: "That part of the boundary line described in the treaty of June 15, 1846, between the continent and Vancouver Island not agreed upon by the Joint Commission." These are signed by John G. Parke and Archibald Campbell. They do not bear the signature of any member of H. B. M. Commission. The date of signing is November 3, 1869.

Of these final maps, the seven detailed sheets showing the land boundary have been photolithographed and a small edition printed. Just when they were printed or how large the edition I have not learned. These photolithographs are on double the scale of the original (i. e., 1:60000). They were printed by the New York Lithographing, Engraving, and Printing Company, Julius Bien, superintendent. The sheets are numbered from east to west, and the seventh or westernmost bears the following title:

> Photo-lithographic Copy of the detailed maps of the North West Boundary from Point Roberts to the Rocky Mountains between the United States and the British Possessions under the Treaty of June 15th, 1846, showing Monuments, Cuts, and other Marks. Archibald Campbell, U. S. Comr. N. W. Boundary Survey. Scale 1:60000 (enlarged to twice the scale of original drawings). Photo-lith. by New York Litho'g Engrav'g and Print'g Co., Julius Bien, Sup't.

The sheets are printed wholly in black, are 28 inches high by 71 inches wide and printed in two pieces. Relief is shown by hachures and timber by the usual convention. Boundary marks are shown by

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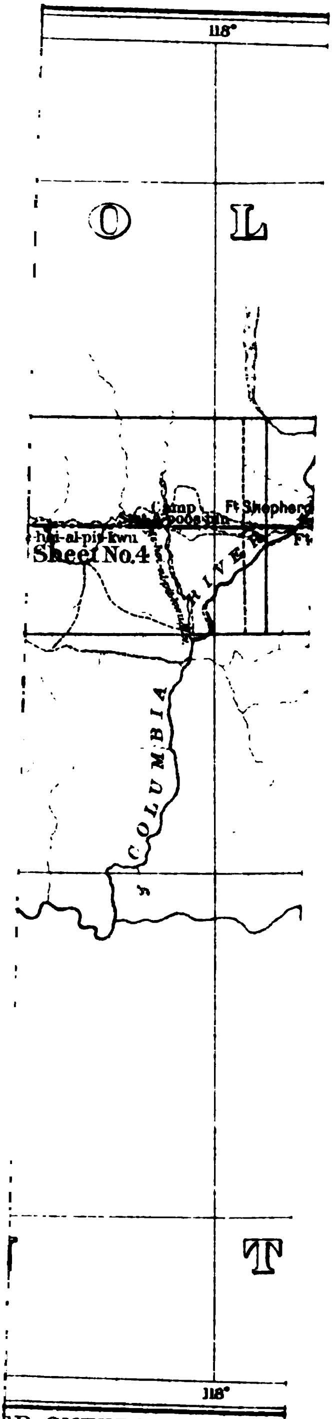
[1] In the library of the Coast and Geodetic Survey I have seen a photograph of this western sheet. It is a pale and faded copy, 18 by 24 inches, was made by Alexander Gardner, and is on a scale of 1:1070000, or about 17 miles to 1 inch.



ED SHEETS OF THE
SURVEY

black circles unaccompanied by names or any designations. Of these maps I have seen copies in the Library of Congress, in the Geological Survey, in the General Land Office, in the Office of the Chief of Engineers, and in the State Department. Some of these are numbered and others not. Could there have been two editions? These sheets cover less territory than the originals. They show the belt of topography, but omit the signatures and legends, if indeed there were any on the copy furnished the lithographer. The copy in the State Department has a clear, strong red line along portions of the boundary and under the title (sheet 7) has the following in the draftsman's hand:

> NOTE.—The red lines indicate the portions of the boundary actually surveyed and marked by vistas cut through the forest and monuments of stone.

In the General Land Office there is a photographic copy of the detailed sheets dated 1866, on which are lines similar to the red ones above mentioned. As to this photographic copy we have the following statement made by Mr. Campbell in a letter to the Secretary of State, dated February 3, 1869:[1]

> In collating the results of the survey * * * complete maps on a large scale [were] made of the entire boundary and the adjacent country. A general map has also been made, showing the extent of the country traversed. And to facilitate the survey of the public lands, photographic duplicates of the detailed sheets showing each monument on the boundary line, with its geographical position, were furnished to the General Land Office.

I have examined these photographs in the General Land Office. There are four of them, each 20 by 70 inches in size, and each composed of several separate photographs, which have been joined together, mounted on cloth, and bound with blue braid. A special title was prepared and photographed for each of these four maps. The title of the easternmost sheet is as follows:

> Photographic Sketch of the detailed Maps of the Boundary between the United States and the British Possessions, showing the Monuments *from Mooyie and Yah'k Divide to Rocky Mountain Divide.* Mapped under the direction of the United States North West Boundary Commission. From Surveys by the Joint Commission to carry into effect the 1st Article of the Treaty between the United States and Great Britain and authorized on the part of the United States by Act of Congress of August 11th 1856.
>
> Archibald Campbell, U. S. Commissioner.
> John G. Parke, U. S. Eng., Chief Astr. and Surveyor.
> G. Clinton Gardner, Ass't Astr. and Surveyor.
> William J. Warren, Secretary.
> John J. Major, Clerk.
> Scale 1: 120000. 1866.

The titles of the others are identical with this, except as to the country covered. This easternmost sheet embraces longitude 113° 45′ to 116°, *from Mooyie and Yah'k Divide to Rocky Mountain Divide;*

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[1] House Ex. Doc. No. 86, Fortieth Congress, third session, p. 96.

the next, longitudes 116° to 118½°, *from Inchuintum River to Mooyie and Yah'k Divide;* the next longitudes, 118½° to 121°, *from Divide of Cascade Mountains to Inchuintum;* and the last, longitudes 121° to 123¼°, *from Point Roberts to Divide of Cascade Mountains.*

The geographic positions of the various camps, stations, etc., are given on these maps, as are also the longitudes of the boundary monuments, accompanied by brief descriptions of the locations. These positions, classified in two groups and arranged in order of longitude, are printed on pages 28–39 of this bulletin.

The preparation of the 13 final original drawings was apparently begun in 1863. There is an autograph memorandum by Mr. G. Clinton Gardner, dated June 30, 1863, containing an estimate of the time required to make these drawings. He estimates that the drawing of seven sheet of 1:120000 scale will take eighty-two weeks' work, and that two sheets of the general map of 1:720000 scale thirty-five weeks' work. After discussing methods and costs he adds:

> The scale spoken of by the English commissioner for the general map was 1:600000, but that scale would require larger sheets than those used for the detailed maps. I have therefore proposed to use for the general maps 1/6 instead of 1/5 of that of the detailed maps in order that all the sheets shall be of uniform size.

As to the drawing of these sheets and their cost, there are three memorandums in the handwriting of Mr. Gardner. The first, undated, is as follows:

Seven detail sheets from Point Roberts to Rocky Mountains, at $600	$4,200
The water-boundary sheet	1,800
The two general sheets, one from Columbia River west	1,500
And the other from Columbia east to Fort Benton	1,000
	8,500

The second memorandum, dated October 31, 1864, is as follows:

The seven detail sheets have cost $4,085, [and] when completed [will cost] $115 [more]	$4,200
The general sheets have cost $1,867, [and] when completed [will cost] $813 [more]	2,500
The water-boundary sheet has cost $750, [and] when completed [will cost] $925 [more]	1,675
Total	8,375

The third memorandum, dated January 1, 1865, is as follows:

Water-boundary sheet	$2,000
Detail sheets, 7 at $600	4,200
General maps, No. 1, $1,800; No. 2, $1,400	3,200
Total cost of the drawing of maps	9,400

Thus it appears that the drawing of these maps was completed late in 1864 or early in 1865. The photographic copy of them in the General Land Office is dated 1866.

The drawing was done by Edward Freyhold, of No. 44 Sharp street, Baltimore, by L. D. Williams, and by Theodor Kolecki. Freyhold did the "hill work"—i. e., the hachures—and the others the outline, lettering, etc. Prior to February, 1864, Freyhold had drawn the hill work on detail sheets 3 and 7.

Among the papers is an unexecuted contract (apparently the original draft) between the United States Northwestern Boundary Commission and Edward Freyhold, whereby Freyhold agrees to draw the hill work on sheets 1, 2, 4, 5, and 6 "similar and not inferior to certain other work executed by him on sheets 3 and 7" for $1.75 per square inch, and to complete the work "before the 31st day of August, 1864."

Sheet 4 was finished March 5, 1864, and contained 214$\frac{1}{2}$ square inches of hill work; sheet 6 was finished April 26, 1864, and contained 249$\frac{1}{2}$ square inches of hill work; sheet 5 was finished June 6, 1864, and contained 137$\frac{5}{16}$ square inches of hill work; sheet 2 was finished August 13, 1864, and contained 225$\frac{1}{64}$ square inches of hill work. There is no record as to No. 1, but it is probable that it was finished on March 5, so that the hill work was all completed by August 13 and the drawing of the final maps completed about the beginning of the year 1865.

BRITISH MAPS.

On June 23, 1871, Sir Edward Thornton, then British minister in Washington, sent to the Department of State an atlas comprising maps, views, and tables of geographic positions of the northwest boundary. This atlas is entitled:

> Maps of the land boundary between the British possessions in North America and the United States as established by the treaty of Washington, 15th June, 1846, and surveyed and marked under the direction of the Joint Commission appointed to carry into effect the 1st article of the treaty. Scale 1:120000, or 1.8939 statute miles to one inch. Photo-zincographed at the ordnance survey office, Southampton, under the superintendence of Cap't. Parsons, R. E., F. R. A. S.; Col. Sir Henry James, R. E., F. R. S., etc., director, 1869.

Then follows:

(a) An index map composed of two double-page sheets on a scale of 1:600000.

(b) Seven detailed sheets, scale 1:120000, numbered 1 to 7 from west to east. All are dated May 7, 1869, and signed by J. S. Hawkins, H. B. M. Comm'r, Archibald Campbell, U. S. Comm'r, Samuel Anderson, Lt. R. Eng'rs Secretary for Captain Haig, R. A., Chief Astronomer. Sheets 1 and 7 were drawn by J. Carroll, 2 by H. Walthouse, and 3, 4, 5 and 6 by F. B. Grose.

(c) A title page for another series of six sheets on the mile scale is as follows:

> Maps of the land boundary between the British possessions in North America and the United States as established by the treaty of Washington 15th June, 1846, and

surveyed and marked under the direction of the Joint Commission appointed to carry into effect the 1st article of the treaty. Scale of 1:63360 or one statute mile to one inch. Photo-zincographed at the ordnance survey office under the superintendence of Captain R. M. Parsons, R. E., F. R. A. S.; Col. Sir H. James, R. E., F. R. S., etc., director, 1869.

The six sheets following this are numbered 1 to 6, from west to east, and are signed "J. S. Hawkins, colonel, Royal Engineers, H. B. M. commissioner, 7th May, 1869." The geographic coordinates of camps and stations are given; topography is shown by hachures, trails are shown in brown, and water in blue. Iron monuments are shown by a square symbol (■) and stone monuments by a round one (●). The vistas and cleared part of the line appear to be indicated by two lines, one down on each side of the parallel, thus, ———═════════———.

(d) Between the title of the mile scale sheets and the sheets themselves are two double pages, the first containing ten photographic views of monuments and vistas, as follows:

Initial monument, stone obelisk, Point Roberts, four views, one of each face.
Boundary monument, Mooyie River.
Boundary monument and cutting, Kootenay East.
Boundary monument and cutting, Yak'h River.
Boundary monument and cutting, Kish-e-nehn.
Boundary monument, watershed Rocky Mountains, looking north.
Boundary monument, watershed Rocky Mountains, looking south.

The second double page contains two tables of geographic coordinates, with descriptions of stations. These tables are printed in this bulletin, pages 29, 31, 33, 35, 37, and 39.

According to these tables there are 161 monuments, marking parts of a boundary line 410 miles long. These are:

Stone obelisk	1
Iron pillars	42
Pyramids of stones	3
Bench marks	2
Mound of earth	1
Piles of stones	112
Total	161

(e) Lastly we have this double title page:

Maps to illustrate the boundary line established by the convention of London, 20th October, 1818, and the treaty of Washington, 15th June, 1846, between the British Possessions in North America and the United States, compiled from the following authorities:

* * * * * * *

Scale of .0528 inches to 1 statute mile, or 1:1200000. Photozincographed, etc. 1869.

This is followed by three double-page photographic maps showing the country between the forty-fifth and fifty-first parallels of north latitude and from the Pacific Ocean eastward to Minnesota.

GEOGRAPHIC COORDINATES.

The geographic positions of various camps and stations in the vicinity of the parallel were determined astronomically. Latitudes were determined with the zenith telescope; azimuth and time with the transit. Longitudes were determined by chronometer, by moon-culminating stars, and at one station, Camp Mooyie, by the solar eclipse of July 7, 1860.

It would seem that 28 fundamental or base stations were established near the boundary. For these stations measurements were made to the parallel. Thereupon other stations, with monuments, were established on the parallel.[1] Of these stations on the parallel there are 161. The description of these fundamental or base stations and of the 161 stations on the parallel, their location, longitude, etc., are given in Tables I to IV herewith. Tables I and III are made up from data on the photographic copies of the final map which were deposited in the General Land Office in 1866. Tables II and IV are copied from the British atlas in the State Department, which was presented by the British minister, Sir Edward Thornton, in 1871. The results from the two sources are almost identical, but as they are not absolutely so, and as the originals are not conveniently accessible, it was deemed best to print, side by side, the results from these two sources.

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[1] For method employed see Appendix A, pp. 64-65.

TABLE I.—*Geographical coordinates of camps, stations, etc.*

FROM AMERICAN SOURCES.

No.	Station.	Latitude.			Longitude.		
		°	′	″	°	′	″
1	Camp Akamina	49	00	52.2	114	03	34
2	Camp Kishenehn	49	00	02.6		21	09
3	Ford of Flathead River	48	57	01.1		24	26.6
4	Junction of trail to Wigwam Station	48	55	31.4		43	33.7
5	Wigwam Station	48	59	42.8		45	02
6	Camp Kootenay East	48	59	44.4	115	11	19.2
7	Yahk'h Station	48	59	55.4		38	51
8	Camp Mooyie	49	01	25.6	116	12	40.5
9	Mooyie trail monument	49	00	01.3		14	59.2
10	Acklew Cache, junction of trails	48	54	21.4		22	02.1
11	Camp Kootenay West	48	59	54.9		31	16.2
12	Kootenay Mountain Station	49	00	12.8	117	10	48.4
13	Pend d'Oreille Station	49	00	03.5		21	52.9
14	Fort Shepherd Station	49	00	00		37	19.4
15	Camp Columbia	48	59	49.1		37	41.8
16	Camp Statapoostin	49	00	13.96	118	16	15.6
17	Inchuintum Station	48	59	58.5		28	12.3
18	Camp Nehoialpitkun	48	59	02.9		44	28.5
19	Camp Osoyoos or Osoyoos Station	48	59	56.4	119	24	12
20	Camp Similkameen	48	59	12.0		34	53.2
21	Nais-nu-loh Station	48	59	52.9	120	00	18.8
22	Junction of trails, Naisnuloh	49	07	54.8		00	59.9
23	Camp Pa-say-ten	48	59	42.2		32	12.8
24	Junction of trails, Pa-say-ten Valley	49	09	38.8		33	38.9
25	Roche Station	48	59	49.8		39	14.8
26	Camp Skagit	49	00	01.8	121	02	45.2
27	Crossing of Skagit River on trail	49	07	42.7		08	29.2
28	Camp Chuch-che-hum	49	00	03.5		16	41.4
29	Camp Chiloweyuck	49	00	21.9		23	41.8
30	En-saw-kwatch Station	49	00	30		30	41.8
31	Sen-eh-say Station	49	00	34.8		36	15.4
32	Camp Tummeahai	49	02	04.9		47	34.4
33	Intersection of Whatcom and Lake trails	48	06	05.4		54	56.8
34	Chiloweyuck Depot	49	09	28.2		57	59
35	Camp Sumass	49	01	25.8	122	11	52.8
36	British Station	49				37	01.6
37	Camp Simiahmoo	49	00	48.1		45	30
38							

TABLE II.—*Geographical coordinates of camps, stations, etc.*

FROM BRITISH SOURCES.

No.	Station.	Latitude.			Longitude.		
		°	′	″	°	′	″
1	Camp Akamina and Station	49	00	52.0	114	03	34.0
2	Camp Kish-e-nehn	49	00	02.8	114	21	09.0
3							
4							
5	Wigwam Station	48	59	42.8	114	45	02.0
6	Camp Kootenay East	48	59	41.6	115	11	19.2
7	Yahk'h Station	48	59	55.4	115	38	57.0
8	Camp Mooyie	49	01	26.0	116	12	40.5
9							
10							
11	Camp Kootenay West	48	59	55.1	116	31	16.2
12	Kootenay Mountain Station	49	00	12.8	117	10	48.4
13	Pend d'Oreille Station	49	00	03.5	117	21	52.9
14	Fort Shepherd Station	49	00	00.0	117	37	19.4
15	Camp Columbia	48	59	50.4	117	37	41.8
16	Camp Stat-a-poos-tin	49	00	10.8	118	16	15.6
17	In-chu-in-tum Station	48	59	58.5	118	28	12.3
18	Camp Ne-hoi-al-pit-kwu	48	59	04.3	118	44	28.5
19	Camp O-so-yoos & O-so-yoos Station	49	00	00.9	119	24	12.0
20	Camp Simil-ka-meen	48	59	12.1	119	34	53.2
21	Nais-nu-loh Station	48	59	53.9	120	00	18.8
22							
23	Camp Pa-say-ten	48	59	42.6	120	32	12.8
24							
25	Roche Station	48	59	49.8	120	39	14.8
26	Camp Skagit	49	00	02.3	121	02	45.2
27							
28	Camp Chuck-che-hum	49	00	03.7	121	16	41.4
29	Camp Chiloweyuck	49	00	22.2	121	23	41.8
30	En-saw-kwatch Station	49	00	30.0	121	30	41.8
31	Sen-eh-say Station	49	00	34.3	121	36	15.4
32	Camp Tummeahai	49	02	04.9	121	47	34.4
33							
34							
35	Camp Sumass and Station	49	01	25.8	122	11	52.8
36	British Station	49	00	00.0	122	43	59.9
37	Camp Simiahmoo Observatory	49	00	43.1	122	45	30.0
38	Obelisk at Initial Point	49	00	00.0	123	03	53.0

TABLE III.—*Locations and longitudes of the boundary monuments.*

FROM AMERICAN SOURCES.

No.	Location of monument.	Longitude.
		° ′ ″
1	Divide of Rocky Mountains	114 03 28.4
2	Left bank of Kishenehn Creek	20 53.9
3	Near trail entering Boundary Pass	21 17.3
4	Second terrace, left bank of Flathead River	27 09.4
5	First bench, right bank of Flathead River	28 02.5
6	West bank of river	45 16.1
7	Hillside, west of river	45 42
8	Small creek, foot of mountain	115 03 28.7
9	Second plateau, left bank of river	10 11.6
10	Right bank of river	11 11.2
11	Brink of ravine, base of mountain	16 01.4
12	Side of hill	38 02.8
13	Ridge of hill	38 29.1
14	Flat, east side of river	39 10.5
15	Flat, west side of river	39 24.5
16	Flat, west of river	39 46.5
17	High bluff, left bank of creek	[a]116 11 24
18	Left bank of creek, water's edge	11 25.6
19	Plateau above creek	[a]11 54
20	Side of mountain, west side of valley	12 22.3
21		
22	Brow of first hill, right bank of river	31 05.9
23	Mountain slope, west side of valley	35 44.9
24	Bench, west side of river	117 08 55.9
25	Mark on face of rock on hillside	09 56.5
26	Right bank of river, meridian of Pend d'Oreille Station	21 52.9
27	Bench, west side of river	22 03
28	Sharp ridge, west side of river	22 54.8
29	Near east bank of river	36 59.4
30		
31	On brink of hill, west bank of river	37 36.2
32	On hilltop, west of Camp Columbia	38 49.1
33	On ridge	41 17.7
34	.....do	45 49.5
35	On ridge between streams	53 08.1
36	.....do	59 00.9
37	On slope of hill between streams	118 01 52.2
38	On slope of hill east	03 17.1
39	On hill between streams	05 15.8
40	On hill west side of stream	09 26

[a] Approximate.

TABLE IV.—*Locations, longitudes, and descriptions of the boundary monuments.*

FROM BRITISH SOURCES.

No.	Location of monument.	Longitude.	Description.	From what station determined.	No. in British Atlas.
		° ′ ″			
1	On the divide of the Rocky Mountains.	114 03 28.41	Pile of stones.	Camp Akamina and Station.	161
2	On left bank of Kishenehn Creek..	20 53.9	.....do........	Camp Kishenehn.	160
3	Near trail entering Boundary Pass.	21 17.3	.....do........	.....do............	159
4	On first bench, right bank Flathead River.	27 09.4	.....do........	.....do............	158
5	On second terrace, left bank Flathead River.	28 02.5	.....do........	.....do............	157
6	Near west bank of river............	45 16.1	.....do........	Wigwam Station .	156
7	On hill west of river	45 42.0	.....do........	.....do............	155
8	At foot of mountains, left bank small creek.	115 03 28.7	.....do........	Camp Kootenay East.	154
9	On second plateau, left bank river.	10 11.6	.....do........	.....do............	153
10	On right bank Kootenay River	11 11.2	.....do........	.....do............	152
11	On east brink ravine beyond which the mountains rise.	16 01.4	.....do........	.....do............	151
12	On hillside east of river	38 02.8	.....do........	Yahk'h Station...	150
13	.....do..............................	38 29.1	.....do........	.....do............	149
14	Near east bank of river	39 10.5	.....do........	.....do............	148
15	On west side of river	39 24.5	.....do........	.....do............	147
16	.....do..............................	39 46.5	.....do........	.....do............	146
17	On high bluff, left bank............	*a*116 11 24	.....do........	Camp Mooyie.....	145
18	On left bank of creek close to water.	11 25.6	.....do........	.....do............	144
19	On plateau above creek	*a*11 54	.....do........	.....do............	143
20	On side of mountain, west side of valley.	12 22.3	.....do........	.....do............	142
21	On trail leading from the north to Cholemta.	14 59.2	.....do........	.....do............	141
22	On brow of first hill, right bank river.	31 05.9	.....do........	Camp Kootenay West.	140
23	On side of mountain, west side of valley.	35 44.9	.....do........	.....do............	139
24	On bench, west side, South Fork Salmon River.	117 08 55.9	.....do........	Kootenay Mt. Station.	138
25	On face of rock on ridge east.......	09 56.5	Bench mark.. ↑	.....do............	137
26	Latitude mark, Pend d'Oreille Station.	21 52.9	Pile of stones.	Pend d'Oreille Station.	136
27	On bench, west side of river........	22 03	.....do........	.....do............	135
28	On high ridge west	22 54.8	.....do........	.....do............	134
29	Near east bank of Columbia River.	36 59.4	.....do........	Fort Shepherd Station.	133
30	Near east bank of river	37 05.2	.....do........	Camp Stat-a-poostin.	132
31	On brink of hill, west bank Columbia River.	37 36.2	.....do........	.....do............	131
32	On hilltop, west of Camp Columbia.	38 49.1	.....do........	.....do............	130
33	On side of hill between streams....	41 17.7	.....do........	.....do............	129
34	.....do..............................	45 49.5	.....do........	.....do............	128
35	.....do..............................	53 08.1	.....do........	.....do............	127
36	.....do..............................	59 00.9	.....do........	.....do............	126
37	On slope between streams..........	118 01 52.2	.....do........	.....do............	125
38	.....do..............................	03 17.1	.....do........	.....do............	124
39	On hill between streams...........	05 15.8	.....do........	.....do............	123
40	On hill west side of stream.........	09 26.0	.....do........	.....do............	122

a Approximate.

TABLE III.—*Locations and longitudes of the boundary monuments*—Continued.

FROM AMERICAN SOURCES—Continued.

No.	Location of monument.	Longitude.
		° ′ ″
41	Side of mountain east of river	118 09 58.4
42	Gravel bench west of river	11 56.1
43	Near the trail to Colville	13 19.1
44	Point of ridge at bend of valley	14 21.0
45	North slope of mountain south of river	16 36.
46	High ridge south of river	18 45.4
47	High ridge south of Nehoialpitkwu River	21 36.8
48	.....do	22 18.6
49	In valley at base of mountain, south	24 07.2
50	.....do	25 38.2
51	In valley south of Nehoialpitkwu River	26 32.6
52	In valley east of Colville trail	27 40.8
53	Near edge of first plateau	28 40.8
54	First plateau west of river	29 48.7
55	First bench west of small creek	31 28.4
56	Summit between creeks	33 43
57	Divide in bend of the Nehoialpitkwu River	36 43.4
58	Sharp ridge between creeks	38 24.9
59	Northern slope of mountain	39 51.5
60	.....do	40 57.2
61	Open country east of Rock Creek	41 49.6
62	.....do	42 38.4
63	.....do	43 24.5
64	East of Colville trail	44 13.8
65	Foot of mountain, right bank of Nehoialpitkwu River	45 12.6
66	Point of ridge in bend of river	45 48.9
67	.....do	46 45.6
68	Foot of mountains south side of valley	48 27.3
69	Point of hill south of creek	51 14.9
70	Ridge between two creeks	52 26.6
71	.....do	53 06.6
72	.....do	55 06
73	.....do	55 58.2
74	Summit east of wagon road	56 58.9
75	In valley east of wagon road	59 33.6
76	High plateau south of Rock Creek	119 01 23
77	.....do	02 54.9

ABLE IV.—*Locations, longitudes, and descriptions of the boundary monuments*—Cont'd.

FROM BRITISH SOURCES—Continued.

No.	Location of monument.	Longitude.	Description.	From what station determined.	No. in British Atlas.
		° ′ ″			
41	On side of mountain east of Neholalpitkwu River.	118 09 58.2	Pile of stones.	Camp Stat-a-poos-tin.	121
42	On a gravel ridge west of river.....	11 56.1	.....do........	.....do...........	120
43	In valley near trail to Colville.....	13 19.1	.....do........	.....do...........	119
44	On point ridge right side of valley.	14 21.0	.....do........	.....do...........	118
45	On north slope of mountains south of river.	16 36.7	.....do........	In-chu-in-tum Station and Camp Stat-a-poos-tin.	117
46	On high ridge south of river.......	18 45.4	.....do........	.....do...........	116
47	.....do...........................	21 36.3	.....do........	.....do...........	115
48	.....do...........................	22 18.6	.....do........	.....do...........	114
49	In valley of Nehoialpitkwu south of river.	24 17.2	.....do........	.....do...........	113
50	.....do...........................	25 38.2	.....do........	.....do...........	112
51	.....do...........................	26 32.6	.....do........	.....do...........	111
52	In valley near and east of Colville trail.	27 40.8	.....do........	.....do...........	110
53	On first plateau west of river.......	28 40.8	.....do........	Camp Ne-hoi-al-pit-kwu and In-chu-in-tum Station.	109
54	.....do...........................	29 48.7	.....do........	.....do...........	108
55	On first bench west of small creek..	31 28.4	.....do........	.....do...........	107
56	On summit between two creeks....	33 43.0	.....do........	.....do...........	106
57	On devide between Rock Creek and Nehoialpitkwu.	36 43.4	.....do........	.....do...........	105
58	On sharp ridge between heads of tributary of Rock Creek.	38 24.9	.....do........	.....do...........	104
59	On southern slope of mountain....	39 51.5	.....do........	.....do...........	103
60	.....do...........................	40 57.2	.....do........	.....do...........	102
61	In open country east of Rock Creek.	41 49.6	.....do........	.....do...........	101
2	.....do...........................	42 38.4	.....do........	.....do...........	100
3	.....do...........................	43 24.5	.....do........	.....do...........	99
4	East of and near Colville trail.....	44 13.8	.....do........	.....do...........	98
5	At foot of mountain, right bank of Nehoialpitkwu River.	45 12.6	Mound of earth.	Camp Osoyoos and Camp Ne-hoi-al-pit-kwu.	97
	On point of ridge in bend of Nehoialpitkwu River.	45 48.9	Pile of stones.	.....do...........	96
	On point of ridge in bend of Nehoialpitkwu.	46 45.6	.....do........	.....do...........	95
	In valley of Nechoialpitkwu.......	48 27.3	.....do........	.....do...........	94
	On point of ridge south and east of creek.	51 14.9	.....do........	.....do...........	93
	On ridge between two creeks......	52 26.6	.....do........	.....do...........	92
	On same ridge.....................	53 06.6	.....do........	.....do...........	91
	.....do...........................	55 05.0	.....do........	.....do...........	90
	.....do...........................	55 58.2	.....do........	.....do...........	89
	On summit east of wagon road to Rock Creek.	56 58.9	.....do........	.....do...........	88
	In valley east of wagon road to Rock Creek.	59 33.6	.....do........	.....do...........	87
	On high plateau south of Rock Creek.	119 01 23.0	.....do........	.....do...........	86
	.....do...........................	2 54.9	.....do........	.....do...........	84

TABLE III.—*Locations and longitudes of the boundary monuments*—Continued.

FROM AMERICAN SOURCES—Continued.

No.	Location of monument.	Longitude.		
		°	′	″
78	High plateau south of Rock Creek	119	04	36
79	Rocky ledge east of small lake		06	15
80	Summit east of creek		08	02.8
81	West bank of creek		09	32.8
82	First bench west of creek		10	18.4
83	Slope of hill north of small lake		11	56.5
84	South and east of Colville trail		14	27.2
85	North and west of small creek		17	10.4
86	Spur from mountain to the north		18	58.1
87	....do		21	26.4
88	Summit of first ridge east of the valley		22	37.6
89	East side of Osoyoos Valley		24	08.9
90	West side of Osoyoos Valley		26	04.5
91	Plateau north of Similkameen River		28	48
92	....do		29	52.6
93	Southern slope of rocky knoll		33	24
94	Ridge east of trail		36	14.6
95	Near trail		37	45.9
96	Isolated mountain east of Similkameen River		39	56.6
97	Left bank of Similkameen River		40	32.7
98	Foot of mountains west side of Similkameen Valley		42	20.9
99	Flat east side of swamp		58	38.7
100	Near small stream		59	57.9
101	Sharp ridge west side of stream	120	00	46.1
102	Bench east side Pa-say-ten Valley		32	00.9
103	Slope west side Pa-say-ten Valley		32	29.3
104	Hillside east of Chuchuwanten River		38	51.9
105	Hillside west of Chuchuwanten River		39	47.2
106	Bench of hill east side of Skagit Valley	121	02	26.6
107	Slope of mountain west side of Skagit Valley		04	22.2
108	Base of mountain south of camp		16	41.4
109	West of and near trail to Skagit		16	56.3
110	East of and near trail to Skagit		18	57.3
111	East side of Klahaihu Valley		23	11
112	West side of Klahaihu Valley		23	48.5
113	East of river		30	08.4
114	On rock west of river		30	21.2

TABLE IV.—*Locations, longitudes, and descriptions of the boundary monuments*—Cont'd.

FROM BRITISH SOURCES—Continued.

No.	Location of monument.	Longitude.	Description.	From what station determined.	No. in British Atlas.
		° ′ ″			
78	On high plateau south of Rock Creek.	119 4 36.0	Pile of stones.	Camp Osoyoos and Camp Ne-hoi-al-pit-kwu.	85
79	On rocky ridge east of small lake ..	6 15.0	.....do	.....do	83
80	On summit east of fork of Rock Creek.	8 02.8	.....do	.....do	82
81	On valley of fork of Rock Creek, west bank.	9 32.8	.....do	.....do	81
82	On first bench west of fork of Rock Creek.	10 18.4	.....do	.....do	80
83	North of small lake.................	11 56.5	.....do	.....do	79
84	Southeast of Colville trail	14 27.2	.....do	.....do	78
85	North and west of small creek	17 10.4	.....do	.....do	77
86	On spur from mountain to the north.	18 58.1	.....do	.....do	76
87	.....do	21 26.4	.....do	.....do	75
88	Summit of first ridge east of Lake Osoyoos.	22 37.6	.....do	.....do	74
89	East of trail up east bank of Lake Osoyoos.	24 08.0	.....do	.....do	73
90	West of trail up west bank of Lake Osoyoos.	26 04.5	.....do	Camp Similkameen and Camp Osoyoos.	72
91	Near divide between Osoyoos and Similkameen and near junction of trail.	28 48.0	.....do	.....do	71
92	On plateau north of Similkameen..	29 52.6	.....do	.....do	70
93	On southern slope of a rocky knoll.	33 24.0	.....do	.....do	69
94	On summit of ridge east of trail up Similkameen.	36 14.6	.....do	.....do	68
95	East of and near trail up Similkameen.	37 45.9	.....do	.....do	67
96	On summit of isolated mountain of Similkameen.	39 56.6	.....do	.....do	66
97	On left bank of Similkameen	40 32.7	.....do	.....do	65
98	At foot mountains west side Similkameen Valley.	42 20.9	.....do	.....do	64
99	On flat east side of stream..........	58 38.7	.....do	Nais-nu-loh Station.	63
100	East and near to stream............	59 57.9	.....do	Nais-nu-loh Station.	62
101	On sharp ridge west side of stream.	120 00 46.1	.....do	.....do	61
102	On bench, east side of Pasayten Valley.	32 00.9	.....do	Camp Pa-say-ten.	60
103	On slope west side of Pasayten Valley	32 29.3	.....do	.....do	59
104	On hillside east of river	38 51.9	.....do	Roche Station....	58
105	On hillside west of station	39 47.2	.....do	.....do	57
106	On side of hill east of Skagit Valley.	121 02 26.6	.....do	Camp Skagit	56
107	On side of mountain west side of Skagit Valley.	04 22.2	.....do	.....do	55
108	At foot of mountain south of camp.	16 41.4	.....do	Camp Chuch-che-hum.	54
109	West of and near trail to Skagit ...	16 56.2	.....do	.....do	53
110	East of and near trail to Skagit	18 57.3	.....do	.....do	52
111	On east side of Klahaihu Valley ...	23 11.0	.....do	Camp Chilloweyuck.	51
112	On west side of Klahaihu Valley...	23 48 5	.....do	.....do	50
113	On east side of Ensaw-kwatch River.	30 08.4	.....do	En-saw-kwatch Station.	49
114	On west side of Ensaw-kwatch River.	30 21.2	Bench mark ↑	.....do	48

TABLE III.—*Locations and longitudes of the boundary monuments*—Continued.

FROM AMERICAN SOURCES—Continued.

No.	Location of monument.	Longitude.		
		°	′	″
115	East side of Sen-eh-say River	121	35	28.4
116	Side of mountain south of creek		42	56.3
117	.....do.		43	31.6
118	Side of mountain west of falls of creek		43	58.1
119	Whatcom trail (last iron pillar) *a*	122	04	45.2
120	Small bench east base of hill		05.	26.6
121	Summit of hill east of Sumass Prairie		06	31.9
122	Bench above rocky precipice		07	21.7
123	Face of hill		07	50.4
124	Small bench west of stream		08	38.4
125	Flat east of stream		10	02.7
126	Rising ground		11	00.8
127	Meridian of Camp Sumass		11	52.8
128	East side of Sumass River		12	46.3
129	Trail west of Sumass River		12	55.2
130	Trail crossing boundary		14	01
131	Trail on sharp ridge west of swamp		15	04.1
132	Flat north of trail		16	29.1
133	Hill east of trail		18	00.6
134	East bank of small lake		19	08.9
135	Trail crossing boundary		19	55.1
136	West of swamp and north of trail		20	29.4
137	Flat north of trail		21	47.6
138	Trail crossing boundary		22	20.7
139	Trail east side of Cullam Creek		23	06.9
140	Flat south of trail		24	22.7
141	.....do		25	04.1
142	Rising ground between swamp and creek		27	19.3
143	Belt of timber between swamps		28	32.9
144	Edge of slope west of swamp		29	37.2
145	Trail west bank of Sehkomehkl Creek		30	07.9
146	Ridge west of Sehkomehkl Creek		31	05.1
147	Flat north of trail		32	13.7
148	Small ridge south of trail		33	27.7
149	Flat south of trail		34	46.7
150	Flat near stream, south of trail		36	08.5
151	Latitude mark, British station		37	01.6
152	First bench and south of trail		37	26.9

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a A pencil note here says: "All iron pillars from western end to Whatcom trail—43 in all—36 given here."

TABLE IV.—*Locations, longitudes, and descriptions of the boundary monuments*—Cont'd.

FROM BRITISH SOURCES—Continued.

No.	Location of monument.	Longitude.	Description.	From what station determined.	No. in British Atlas.
		° ′ ″			
115	On east side of Sen-eh-say, or Selacee, River.	121 35 28.4	Pile of stones.	Sen-eh-say Station	47
116	On side of mountain south of creek.	42 56.3	Pyramid of stones.	Camp Tummea-hai.	46
117	.....do	43 31.6	.....do	.....do	45
118	On side of mountain west of falls of creek.	43.58.1	.....do	.....do	44
119	On De Lacy's trail, Whatcom to Fort Hope, crossing line.	122 4 45.2	Iron pillar....	Sumass Station and Camp.	43
120	On bench at base of hill	5 26.6	.....do	.....do	42
121	On top of mountain east side of Sumass Prairie.	6 31.9	.....do	.....do	41
122	On bench above rocky precipice east of trail.	7 21.7	.....do	.....do	40
123	On face of hill 5 chains from base and near trail.	7 50.4	.....do	.....do	39
124	On bench west of stream	8 38.4	.....do	.....do	38
125	On flat east of stream	10 02.7	.....do	.....do	37
126	On mound east of latitude mark	11 00.8	.....do	.....do	36
127	Latitude mark Sumass	11 52.8	.....do	British Station	35
128	On east side of Sumass River	12 46.3	.....do	.....do	34
129	On Whatcom trail west side Sumass River.	12 55.2	.....do	.....do	33
130	On trail crossing boundary line	14 01.0	.....do	.....do	32
131	On top of hill west of swamp and on trail crossing line.	15 04.1	.....do	.....do	31
132	On flat north of trail and west of swamp.	16 29.1	.....do	.....do	30
133	On hill 20 chains east of trail crossing line.	18 00.6	.....do	.....do	29
134	On east side small lake	19 08.9	.....do	.....do	28
135	On trail crossing boundary line	19 55.1	.....do	.....do	27
136	On west side of swamp and north of trail.	20 29.4	.....do	.....do	26
137	On flat north of trail	21 47.6	.....do	.....do	25
138	On trail crossing boundary line	22 20.7	.....do	.....do	24
139	On trail crossing boundary line east side of creek.	23 05.9	.....do	.....do	23
140	On flat south of trail	24 22.7	.....do	.....do	22
141	.. ..do	25 04.1	.....do	.....do	21
142	On slightly elevated ground west of creek.	27 19.3	.....do	.....do	20
143	On belt of timber between swamps.	28 32.9	.....do	.....do	19
144	On edge of slope west of stream and south of trail.	29 37.2	.....do	.....do	18
145	On trail crossing line west side of Seh-ko-mehl Creek,	30 07.9	.....do	.....do	17
146	On ridge west of Seh-ko-mehl Creek.	31 05.1	.....do	.....do	16
147	On flat north of trail	32 13.7	.....do	.....do	15
148	On ridge south of trail and stream	33 27.7	.....do	.....do	14
149	On flat south of trail	34 46.7	.....do	.....do	13
150	On flat near stream south of trail	36 08.5	.....do	.....do	12
151	Latitude mark, British station	37 01.6	.....do	.....do	11
152	On first bench south of trail	37 26.9	.....do	.....do	10

TABLE III.—*Locations and longitudes of the boundary monuments*—Continued.

FROM AMERICAN SOURCES—Continued.

No.	Location of monument.	Longitude.
		° ′ ″
153	Slope south of trail	122 38 45.5
154	Flat west of ravine	40 04.1
155	....do	41 22.7
156	Small ridge between swamps	42 20.5
157	Parallel station	43 59.9
158	East side of Point Roberts	123 00 42.9
159	Ridge on Point Roberts	02 12.7
160	Flat east of Obelisk	03 02.9
161	Initial Point, Obelisk of stone	03 53

TABLE IV.—*Locations, longitudes, and descriptions of the boundary monuments*—Cont'd.

FROM BRITISH SOURCES—Continued.

No.	Location of monument.	Longitude.	Description.	From what station determined.	No. in British Atlas.
		° ′ ″			
153	On slope south of trail	122 38 45.6	Iron pillar	British Station	9
154	On flat west of ravine	40 04.1	.....do	.....do	8
155	.....do	41 22.7	.....do	.....do	7
156	On small ridge between swamps	42 20.5	.....do	.....do	6
157	Near high-water mark, Simiahmoo Bay.	43 59.9	.....do	.....do	5
158	On east side of Point Roberts	123 00 42.9	.....do	Camp Simiahmoo observatory.	4
159	On ridge	02 12.7	.....do	.....do	3
160	On flat east of Obelisk, Point Roberts.	03 02.9	.....do	.....do	2
161	On west face of Point Roberts	03 53.0	Obelisk	.....do	1

MAGNETICS.

Both the British and the American surveyors were equipped with an outfit of instruments for determining the magnetic declination, dip, and force. The British instruments were standardized at Greenwich, and the resulting elements at 23 stations, as obtained by Captain Haig, were discussed by General Sabine and published in the Philosophical Transactions. An abstract of these results is printed on page 42 of this bulletin.

As to the results by the American parties, much, unfortunately, must be left to inference, their results being, supposedly, in the "lost report." Mr. Campbell, writing in 1869,[1] says: "A magnetic survey extending over a range of 3° 20′ in latitude and 4° in longitude, with the necessary observations of the magnetic elements of the astronomical stations, was also made." The work appears to have been done by Mr. J. S. Harris, whose results were secured by the United States Coast Survey. From these it appears that the observations covered a considerably larger extent of territory than that above indicated by Mr. Campbell. The character of the instrumental outfit and its fate in the field can be inferred, in part, from the two following passages from General Parke's report of progress, written November 12, 1859: "A full set of magnetic observations were made at one station" (in 1858).[2] Also, "I am happy to report that we have got thus far through the season's work without any damage to our astronomical instruments. I regret, however, that we have been less fortunate with the magnetic instruments. The mule carrying these missed his footing and rolled down a precipitous bank. The magnetic theodolite will have to be replaced, and the other instruments will require repairing."[3]

The Coast and Geodetic Survey has furnished from its manuscript registers the following table of results for declination, dip, and intensity.

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[1] House Ex. Doc. No. 86, Fortieth Congress, third session, p. 95.

[2] Senate Ex. Doc. No. 16, Thirty-sixth Congress, first session, p. 6.

[3] Same, pp. 6-7

Declination, dip, and force for the mean epoch 1860.

[Results from observations by Joseph S. Harris, United States Northwestern Boundary Commission, 1858 to 1861. From manuscript furnished by the United States Coast and Geodetic Survey.]

Station.	Latitude.		Longitude.		East declination.		Dip.		Horizontal force·		Total force.
									Br. units.	C. G. S. units.	C. G. S. units.
	°	′	°	′	°	′	°	′			
Magnetic station	49	00	114	21	22	58	....		....	....	....
Do	48	59	115	10	22	58	....		....	....	....
Camp No. 11	49	07	115	16	....		73	37	....	....	....
Camp No. 14, Joseph Prairie	49	31	115	35	23	34	73	49	3.757	0.1782	0.6217
Magnetic station	49	00	116	33	22	37	....		....	....	....
Do	48	42	116	19	22	16	....		....	....	....
Do	48	10	116	45	21	49	....		....	....	....
Peon Prairie	47	44	117	14	21	53	72	05	4.099	0.1890	0.6146
Spokane Ferry	47	49	117	49	22	07	71	52	4.132	0.1905	0.6123
Colville Depot	48	34	117	52	22	31	72	31	3.976	0.1833	0.6100
Tukannon River	46	32	118	00	20	55	70	22	4.380	0.2020	0.6009
Lugenbeel Creek	47	09	118	06	20	55	71	19	4.229	0.1950	0.6085
Cow Creek	46	53	118	10	21	01	71	01	4.301	0.1983	0.6097
Dry Creek	46	09	118	18	20	13	70	47	4.289	0.1978	0.6007
Magnetic station	46	03	118	25	20	00	....		....	....	....
Do	49	00	118	44	22	07	....		....	....	....
Near Wallula	46	02	119	00	19	46	....		....	....	....
Camp Osoyoos	49	00	119	24	....		72	33	....	....	....
Magnetic station	49	00	119	35	23	34	....		....	....	....
Do	49	03	120	55	24	19	....		....	....	....
Skagit	49	00	121	03	....		72	40	3.983	0.1812	0.6084
Magnetic station	49	05	121	07	22	23	....		....	....	....
Camp Chiloweyuck	49	01	121	23	22	09	72	25	4.025	0.1856	0.6141
Magnetic station	48	59	121	42	22	47	....		....	....	....
Do	49	01	121	45	22	55	....		....	....	....
Do	48	59	121	57	22	39	....		....	....	....
Semiahmoo	49	01	122	46	22	55	72	01	4.094	0.1888	0.6115
Point Roberts	48	59	122	58	22	39	71	46	4.111	0.1896	0.6056

Declination, dip, and force for the mean epoch 1860.

[Abstract of results obtained by Capt. R. W. Haig, R. A., with standard instruments, between August, 1858, and August, 1861, in connection with the survey of the northwest boundary. From Philosophical Transactions of the Royal Society, 1864, vol. 154, pp. 161-166.]

Station.	Latitude.	Longitude.	East declination.	Dip.	Total force.	
					Br. units.	C. G. S. units.
	° ′	° ′	° ′	° ′		
Akamina station	49 01	114 04	22 56	73 38	13.522	0.6235
Wigwam station	49 00	114 45	22 50	73 30	.496	0.6223
Tobacco Plains (Kootenay)	48 57	115 08	....	73 24	.481	0.6216
On Kootenai River	48 40	115 17	22 36	73 09	.460	0.6206
South Crossing (Kootenay)	48 22	115 21	22 28	72 55	.443	0.6198
Chelemta	48 41	116 19	22 27	72 59	.423	0.6189
Pack River	48 22	116 28	22 19	72 43	.401	0.6179
Sinyakwateen	48 09	116 44	22 10	72 30	.298	0.6104
Chemikane River	48 00	117 45	21 57	72 12	.334	0.6148
Colville B. B. C. Barracks	48 40	118 05	22 11	72 39	.357	0.6159
Inshwointum	49 00	118 28	22 15	72 50	.361	0.6161
Osoyoos station	49 00	119 24	22 07	....	....	....
Ashtnolou station	49 00	120 00	22 12	72 34	.306	0.6135
On Ashtnolou River	49 07	120 00	22 04	....	....	....
Do	49 10	120 00	22 06	72 42	.315	0.6139
Dalles, 8-mile camp	45 40	120 49	....	69 49	.091	0.6096
Dalles, 3-mile camp	45 35	120 49	20 27	69 45	.087	0.6094
Chiluweyuk	49 02	121 23	....	72 21	.257	0.6113
Schweltza Lake	49 02	122 00	21 44	72 14	.234	0.6102
Sumass Prairie	49 01	122 12	21 42	72 11	.226	0.6098
Nisqually	47 07	122 25	20 51	70 39	.111	0.6045
Fort Vancouver	45 38	122 28	20 13	69 28	.026	0.6006
Esquimalt	48 26	123 27	21 20	71 30	.148	0.6062

ELEVATIONS.

Elevations were determined along and near the boundary by both the American and British parties throughout the progress of the survey. Most of them were measured barometrically; a few were determined by triangulation.

Among the State Department papers is a short summary or table of heights determined by the British, and a longer and incomplete list of elevations determined by the United States parties.

The British list, contained on two leaves of blue foolscap paper, is entitled: "Abstract of the principal heights determined by barometrical measurements on the line of the North American boundary in the years 1859, 60–61."

The table contains eight columns. The first gives the year; the second, name of station; third, latitude; fourth, longitude; fifth, barometer (always marked A or M, meaning probably aneroid or mercurial); sixth, number; seventh, elevation above sea level; eighth, how determined. The paper is not dated or signed. Columns 2, 3, 4, and 7 of that table are here printed on pages 43 and 44.

The American list is entitled: "Data concerning the determination of altitudes by the U. S. N. W. Boundary Commission in the years 1857, 58, 59, and 60."

This data is contained in two cahiers, of six double sheets each, designated Vol. I and Vol. II. The first one has been revised throughout; the second one is apparently revised in part only and is incomplete. The data is in nine columns. The first gives the date "when occupied;" the second, the name of station; third, barometer (designated by number, 790, 1224, 1219, 1226); fourth, number; fifth, latitude; sixth, longitude; seventh, observer; eighth, altitude; ninth, remarks. We here print columns 2 and 9 (consolidated), 5, 6, and 8.

Elevations along the forty-ninth parallel from the Pacific Ocean to the Rocky Mountains, determined barometrically, in the years 1857–1860, by the British Northwestern Boundary Commission.

No.	Station.	Latitude.			Longitude.			Elevation.
		°	′	″	°	′	″	*Feet.*
1	River about 2 miles below lower end of Chief Mountain Lake	...			...			5,028
2	Watershed in South Kootenai Pass	...			...			6,970
3	Mountain near following station	...			...			8,454
4	End of boundary line, watershed in latitude 49°	49	0	00	114	3	25	7,524
5	Terminal latitude station	49	0	52		3	34	6,548
6	Watershed on trail below Summit Station	49	1	26		3	54	5,859
7	Mule Camp	49	3	38		7	30	5,191
8	Junction of trails south of Kootenai Pass	49	5	39		11	42	4,753
9	Flathead latitude station	49	0	00		21	06	4,136
10	Ford of Flathead River	48	57	01		24	24	4,073
11	Flathead Valley, upper terrace	48	56	18		28	40	4,267
12	Wigwam River Station	48	59	43		45	02	4,694
13	Watershed, Tobacco and Wigwam	48	57	23		45	02	5,332
14	Camp [near head of Tobacco River, homeward]	48	53	06		45	43	4,350
15	Camp near head of Tobacco River [outward]							4,358
16	Camp on Tobacco River—homeward	48	49	04		53	52	2,998
	Camp on Tobacco River—outward							3,103
17	Mooyie cutting	49	00	00	116	11	40	2,252
18	Crossing of Mooyie River	48	54	08		11	38	2,142
19	Second ridge west of Yakh River	48	54	17		8	30	4,466
20	First ridge west of Yakh River	48	33	55		4	00	5,791
21	High peak above following station	...			...			8,531
22	Watershed, Kootanie and Yakh rivers	48	58	13	115	25	00	7,664
23	Watershed at head of Mooyie River	49	27	00	115	46	00	2,920
24	Yakh River Station	48	59	55		38	48	2,927 2,998
25	Third crossing, Kootanie River on Tobacco plains near trading post	48	37	30		10	00	2,228 2,296 2,300
26	Second crossing, Kootanie River	48	22	01		26	30	2,136
27	Chelempta Kootanie River	48	41	15	116	34	24	1,712
28	Sinyakwateen Ferry	48	09	16		50	20	1,996
29	Lake 9 miles south of Sinyakwateen	48	00	03		52	00	2,192
30	Edge of wood, Spokane plains	48	48	35	117	00	45	2,143

Elevations along the forty-ninth parallel, etc.—Continued.

No.	Station.	Latitude.			Longitude.			Elevation.
		°	′	″	°	′	″	*Feet.*
31	Plants house	48	42	50	117	17	00	2,018
32	Little Spokan Springs	48	46	10		29	00	1,641
33	Spokan River—west bend	47	58	20		40	30	1,423
34	Chém-a-kane bridge	48	0	14	116	46	24	1,890
35	N. A. B. C. Barracks, at Colville, Columbia River	48	39	58	118	05	10	1,268 1,396
36	Fort Shepherd	49	01	05	117	36	58	1,405
37	Third boundary crossing of Colville River	48	58	26	118	13	28	1,534
38	Statapoostin Station	49	00	13		17	09	1,515
39	Camp 8¼ miles below In-chú-in-tum Station	49	00	23		25	00	1,871
40	In-chú-in-tum Station	49	00	01		30	13	1,991
41	Camp on line near Rock Creek	48	59	30	119	02	10	2,351
42	Haigs Pond	49	00	00		8	40	3,784
43	Camp Archer, near Osoyoos	48	59	50		19	05	2,880
44	Larchtree Hill	49	00	00		13	00	3,964
45	Similkameen River, near Vermilion Forks							1,597
46	Camp above Similkameen							3,081
47	Camp near Moodys Flat							4,119
48	Camp 21 miles out on road							1,652
49	Fort Hope							*a* 140
50	Osoyoos Lake	49	00	00	119	26	40	757 928 949
51	Similkameen River							1,180
52	Haynes house	49	02	00	119	43	00	1,130
53	Similkameen—lower ford	49	12	05		53	10	1,244
54	Highest Ashtnolon Mountain	48	58	40	120	01	30	*b* 7,500
55	Ashtnolon Station	48	59	54		02	44	5,558
56	Upper Ashtnolon Ford	49	08	00		03	15	2,431
57	Ashtnolon Cache	49	07	20		19	20	3,556
58	Ptarmigan Hill	49	08	40		26	00	6,331
59	Mouth of Pasayten River	49	09	55		35	55	3,060
60	Roche River Station	48	59	50		41	20	4,300
61	Mouth of Roche River	49	08	30		44	40	3,774 3,459
62	Camp about 600 feet below summit on east side of Hozomeen outward returning	49	02	05		59	30	5,538 5,527
63	Summit of Hozomeen Pass	49	02	40	121	00	45	6,277
64	Skagit Ford	49	08	00		11	05	1,640 1,634
65	Chuchchehum Pass		00	20		17	40	4,719
66	Chiloweyuck Lake		01	30		25	10	2,052

a Assumed. *b* Approximate.

Elevations along the forty-ninth parallel from the Pacific Ocean to the Rocky Mount determined barometrically in the years 1857–1860 by the United States Northwe Boundary Commission.

No.	Station.	Latitude.	Longitude.	Elevation.
		° ′	° ′	*Feet.*
1	Camp Simiahmoo	49 00.7	122 45.5	11
2	Camp Sumass	01.4	11.9	14
3	Sumass Creek, mouth of; by the creek and lake about 15 miles below Camp Sumass, about 57 miles from the sea; ordinary tides rise here about 1 foot	08.7	04.3	7
4	Mountains east of Pekosie Lake	48 58.5	01.0	4,991
5	Harrison Lake	49 19.1	121 43.4	30
6	Harrison or Shook-o-meh River, mouth of	....	....	20
7	Chiloweyuck River, near Hudson Bay Company fishery	....	....	15
8	Hach-tcha village, about 77 miles above mouth of Fraser River	....	....	29
9	Skow-aal-hu village, about 90 miles above mouth of Fraser River	....	....	70
10	Fort Hope, altitude of Fraser River	....	....	120
11	Indian village on Chiloweyuck River, 5 miles above Chiloweyuck Depot	49 07.8	121 55.0	77
12	Foot of first high ridge after leaving Chiloweyuck Depot	06.9	56.2	179
13	Chiloweyuck River, north bank, 14 miles above Chiloweyuck Depot, in flat below mouth of Tummeahai Creek, at foot of first mountain over which trail passes	05.0	51.9	419
14	Chiloweyuck River; Frenchmans Camp, 21 miles above Chiloweyuck Depot	05.1	42.3	723
15	Chiloweyuck River; mouth of Utzetza (second large tributary from the north), 26 miles above Chiloweyuck Depot	06.6	36.8	1,071
16	Chiloweyuck River; Samana village, 24 miles above Chiloweyuck Depot and 2 miles above mouth of Senehsay Creek	05.8	39.3	913
17	Chiloweyuck River; 33 miles above Chiloweyuck Depot and 3 miles below Chiloweyuck Lake	06.0	30.7	1,550
18	Chiloweyuck River, 10 miles above Chiloweyuck Depot	06.0	57.3	157
19	Trail, Chiloweyuck Depot to Chiloweyuck Lake; spring west of summit of first high ridge	05.7	54.4	1,027
20	Trail, Chiloweyuck Depot to Chiloweyuck Lake, summit first ridge	05.5	54.2	1,268
21	Tummeahai Creek, mouth of (25 feet above water), 15 miles above Chiloweyuck Depot	04.4	49.3	400
22	Chiloweyuck Depot (15 feet above mean water), 63 miles from the sea	09.5	58.0	39
23	Camp Tummeahai, 3 miles above mouth of Tummeahai Creek	02.1	47.6	1,146
24	Forks of Tummeahai, 7 miles above mouth of Tummeahai Creek	00.2	43.8	2,056
25	Put-lush-go-hap Lake, on Main Fork Tummeahai Creek, 10 miles above its mouth	48 58.5	41.0	3,639
26	Foot of rapids in Tummeahai Creek, below lake, 9¼ miles from creek's mouth	59.2	41.3	2,915
27	Divide between Tummeahai Creek (Main Fork) and Sen-eh-say and Nooksahk, 12 miles above mouth of Tummeahai Creek, 11 miles from mouth of Sen-eh-say Creek, and 5 miles from Nuquoichum, tributary of the Nooksahk	57.4	39.4	6,117
28	Tummeahai Creek (head of South Fork), 11 miles above mouth of Tummeahai Creek	57.8	44.9	3,745
29	Divide between Nooksahk and Tummeahai (South Fork), 11¼ miles above mouth of Tummeahai Creek and 14 miles above Cowap, tributary of the Nooksahk	57.4	44.8	5,893

Elevations along the forty-ninth parallel, etc.—Continued.

No.	Station.	Latitude.		Longitude.		Elevation.
		°	′	°	′	*Feet.*
30	La-yome-sin Creek, crossing about ½ mile above mouth, 11 miles above Chiloweyuck Depot	49	04.3	121	54.0	572
31	La-yome-sin Creek, 4 miles above mouth		02.8		52.9	1,026
32	Summit, east head of La-yome-sin and Nooksahk, 8 miles above mouth of La-yome-sin		00.0		49.4	5,212
33	Summit of mountain in divide between La-yome-sin and Tummeahai, near junction of this ridge with the Chiloweyuck-Nooksahk divide		00.4		49.6	4,930
34	Chiloweyuck-Nooksahk divide, highest point in this immediate vicinity	48	59.2		53.0	5,200
35	Summit Kaisootst Mountain		57.8		57.0	5,289
36	Summit Signal peak		59.2	122	00.1	4,991
37	Summit Tummeahai	49	01.9	121	45.1	6,633
38	Divide between Nooksahk and Tummeahai	48	57.3		43.5	5,893
39	Summit La-yome-sin Mountain	49	01.9		50.5	5,884
40	Summit Klehtlakeh Mountain		11.0		40.0	6,840
41	Near summit Put-lush-go-hap Mountain	48	59.7		38.8	*a* 7,195
42	Summit Put-lush-go-hap Mountain		59.7		38.8	7,687
43	Sen-eh-say Creek, mouth of, 22 miles above Chiloweyuck Depot	49	04.0		40.8	823
44	Sen-eh-say Creek, 5 miles from mouth, at mouth of Chuchum Creek		02.0		38.0	1,621
45	Sen-eh-say Creek, 8 miles from mouth, at forks	48	59.8		36.7	2,394
46	Sen-eh-say Creek, 11 miles from mouth, at head of West Fork		57.7		39.4	3,302
47	En-saaw-kwatch Creek, mouth of, 29 miles above Chiloweyuck Depot	49	05.5		34.7	1,296
48	En-saaw-kwatch Creek, 4 miles above its mouth		02.2		32.7	2,900
49	En-saaw-kwatch Creek, heads of, 10 miles above its mouth	48	58.5		29.4	5,073
50	Divide between two western tributaries of Klab-neh Creek, 4½ miles from mouth of tributaries		57.4		28.3	5,617
51	High point on same divide; En-saaw-kwatch and Klab-neh		57.0		28.4	6,856
52	First western tributary of Klab-neh Creek, 4 miles above its mouth		58.2		27.3	4,317
53	First western tributary of Klab-neh Creek, mouth of, 2 miles above mouth of Klab-neh and 42½ miles above Chiloweyuck Depot		59.6		23.5	2,076
54	Camp Chiloweyuck on Klab-neh Creek, 1 mile above Lake Depot	49	00.4		23.7	2,002
55	Lake Depot on Chiloweyuck Lake (6 feet above lake level, approximately)		01.8		23.0	1,997
56	Peak west of Chiloweyuck Lake		02.2		26.6	7,244
57	Pekosie Lake, 4 miles above mouth of Pekosie Creek	48	58.9	122	02.8	790
58	Nooksahk River, 46 miles above mouth, and 4 miles above mouth of Pekosie Creek		55.6		02.5	635
59	Nooksahk River, 50 miles above mouth, at mouth of Cowap Creek		58.7	121	57.0	701
60	Nooksahk River, 53 miles above mouth, near mouth of Noochsakatsu, South Branch		58.3		55.1	*b* 936
61	Nooksahk River, 56 miles above mouth, near mouth of Tchahko, South Branch		58.2		52.0	1,299
62	Nooksahk River, 62 miles above mouth, right bank		53.9		44.7	1,307
63	Nooksahk River, 66 miles above mouth, right bank, at mouth of Nuquoichum		54.1		40.3	2,044
64	Head of Nuquoichum, 4½ miles from mouth		57.8		38.0	5,451

[a] "Summit perhaps 300 feet higher." H. Custer, 1863.

[b] Observations taken on the trail and "should not perhaps be taken as the height of the river."

Elevations along the forty-ninth parallel, etc.—Continued.

No.	Station.	Latitude.		Longitude.		Elevation.
		°	′	°	′	*Feet.*
65	Limit of growth of timber, Put-lush-go-hap Mountain	49	00.0	121	39.0	6,593
66	....do	48	57.5		37.5	6,117
67	Kockolum Creek, half mile above mouth (mouth is half mile below Chiloweyuck)	49	05.7		26.2	1,978
68	Kockolum Creek, 3 miles above mouth, outlet of first lake (Kehkawalum)		07.2		25.6	2,652
69	Kockolum Creek, 4½ miles above mouth, between two lakes		08.8		24.8	2,843
70	Kockolum Creek, 5½ miles above mouth, divide from Klehkwunnum; near head of Indian Lake and 4 miles from mouth of this tributary of Klehkwunnum		09.5		24.8	3,259
71	Water of second lake, 16 miles from mouth of Klehkwunnum [a]		09.6		24.4	3,132
72	Klehkwunnum Creek, mouth of Pips Creek		12.8		21.4	1,917
73	Klehkwunnum Creek, 19 miles from mouth, marsh lakes near head of		10.0		18.0	1,927
74	Divide between Skagit and Fraser rivers, head of Kle-sil-kwu Creek [b]		09.3		16.8	1,948
75	Junction of Man-sel-pan-ik and Kle-sil-kwu creeks.		07.8		13.6	1,820
76	Junction of Man-sel-pan-ik and Kle-sil-kwu creeks, 4½ miles above mouth of Kle-sil-kwu		08.0		13.0	1,860
77	High mountain, northeast side of Klehkwunnum.		10.6		14.5	6,480
78	Skagit Ford, 110 miles from mouth of Skagit River.		07.7		08.5	1,752
79	Man-sel-pan-ik Creek, 4 miles from junction with Kle-sil-kwu Creek		04.6		14.5	3,027
80	Man-sel-pan-ik Creek, 7 miles from junction with Kle-sil-kwu Creek		02.4		14.8	3,491
81	Man-sel-pan-ik Creek, 7½ miles from junction with Kle-sil-kwu Creek, first western tributary		01.6		14.4	3,550
82	Man-sel-pan-ik Creek, 8 miles from junction with Kle-sil-kwu Creek, where Whatcom trail strikes it		01.2		14.4	4,080
83	Man-sel-pan-ik and Skagit divide, second summit on Whatcom trail		01.9		13.4	5,718
84	Summit on trail, Chuch-che-hum to Skagit, 9 miles from mouth of Man-sel-pan-ik; 7 miles from mouth of Chuch-che-hum		00.6		15.3	4,505
85	Lowest point of same divide		00.5		15.8	4,445
86	Head of gorge 150 yards west of divide		00.4		15.1	4,148
87	Summit of old Whatcom trail		00.9		16.3	5,664
88	Blue Lake, 6 miles from mouth of Chuch-che-hum Creek		00.4		15.6	3,725
89	Divide, Chiloweyuck-Skagit-Fraser		02.3		16.3	6,887
90	Camp Chuch-che-hum, 5½ miles from mouth of Chuch-che-hum Creek		00.1		16.7	3,420
91	Nef Prairie, 3 miles southeast of Lake Depot		00.2		20.2	2,592
92	Klab-neh Creek, 4 miles from mouth	48	58.0		22.6	2,078
93	Klab-neh Creek, 5 miles from mouth, first tributary from the east		57.2		23.1	2,090
94	Klab-neh Creek, 7 miles from mouth, near second large tributary from the east		55.8		23.3	2,243
95	Klab-neh Creek, 9½ miles from mouth, near third large tributary from the east		54.8		25.2	2,414
96	Klab-neh Creek, 10 miles from mouth		54.0		25.6	2,588
97	Near summit of ridge west of Klab-neh		54.0		26.9	4,410

[a] This is supposed to be the lowest of all the divides between these two streams, 20 miles from mouth of Klehkwunnum Creek and 7 miles from mouth of Kle-sil-kwu Creek.

[b] This stream is supposed to fall gently till near its entrance into Fraser River, 2 miles below Fort Hope, where it becomes rapid.

Elevations along the forty-ninth parallel, etc.—Continued.

No.	Station.	Latitude.		Longitude.		Elevation.
		°	′	°	′	*Feet.*
98	Summit of Goat Mountain; divide between Klab-neh and Zakeno (tributary of the Skagit), 30 miles above mouth of Zakeno, 50 miles above mouth of Skagit, and 16 miles from mouth of Klab-neh	48	51.7	121	24.0	5,862
99	On divide Klaheh Creek, a branch of Red Mountain Creek, 4 miles above mouth of latter		52.0		24.2	5,106
100	Red Mountain Creek		52.6		23.1	2,932
101	Red Mountain Creek, 4½ miles above mouth, near head of southern branch		50.9		21.4	3,754
102	Divide Klab-neh and Glacier creeks, 8½ miles above mouth of Red Mountain Creek, 15 miles above mouth of Glacier Creek		52.0		17.6	5,107
103	Glacier Creek (Sko-mel-pua-nook), head or first forks of, 13½ miles above its mouth		52.0		15.4	2,891
104	Glacier Creek, 11 miles above its mouth		52.9		13.4	2,550
105	Glacier Creek, 9 miles above its mouth		53.3		11.2	2,292
106	Glacier Creek, 5 miles above its mouth		54.4		08.0	2,075
107	Glacier Creek, 2½ miles above its mouth		54.4		04.7	1,940
108	Glacier Creek, mouth of, junction with Skagit, 84 miles from mouth of Skagit		55.0		02.4	1,525
109	Skagit River, 87 miles above its mouth		57.2		03.4	1,531
110	Skagit River, 82 miles above its mouth		53.5		01.2	1,468
111	Skagit River, 71 miles above its mouth		48.6		01.6	1,405
112	Skagit River, 64 miles above its mouth		44.2		02.0	1,298
113	Camp Skagit, 96 miles above mouth of Skagit (15 feet above river)	49	00.0		02.8	1,573
114	Skagit Cache, in Skagit Valley, 2 miles east of river.		02.2		01.2	1,748
115	Camp on tributary of Skagit, ½ mile above mouth; its mouth 97 miles above Skagit's mouth		01.5		02.0	1,586
116	Camp on tributary of Skagit (Ne-pó-pe-eh-kum), 1 mile above mouth; its mouth 99 miles above Skagit's mouth		02.6		03.1	1,611
117	Camp on Skagit (15 feet above water), 100 miles above Skagit's mouth		02.9		04.0	1,624
118	Camp on Skagit (25 feet above water), 101 miles above Skagit's mouth		03.6		04.3	1,637
119	Camp on slough of Skagit, 104 miles above Skagit's mouth		04.7		05.0	1,675
120	Camp on Skagit (20 feet above water), 108 miles above Skagit's mouth		06.7		07.2	1,727
121	Skagit River, 115 miles above its mouth		11.0		02.6	1,812
122	Skagit River, 120 miles above its mouth, above mouth of Kullas Creek		14.1		03.0	1,947
123	High point on divide, Skagit-Similkameen		18.3	120	56.8	6,871
124	Camp near Skagit-Similkameen divide, 126 miles from mouth of the Skagit		17.8		58.1	5,254
125	Near head of large tributary to the Skagit, 9 miles from its entrance into the Skagit, at which point the elevation is about 1,980 feet, the point being 122 miles above its mouth		16.3		52.1	2,969
126	Summit of pass between Skagit and Similkameen, 126 miles from mouth of Skagit		17.9		59.0	5,668
127	Lake, head of Similkameen, 125 miles from mouth of Similkameen		18.3		57.5	5,307
128	Camp, first forks, [a] 122 miles from mouth of Similkameen		21.6		53.7	4,168
129	On divide, crossing a great bend of the Similkameen		23.2		52.0	5,074
130	Fort Hope trail, 1 mile east of junction with Whatcom, near two small lakes		25.8		52.5	5,947
131	High point on trail		25.0		51.9	5,490

[a] Whatcom trail leaves river.

Elevations along the forty-ninth parallel, etc.—Continued.

No.	Station.	Latitude.		Longitude.		Elevation.
		°	′	°	′	*Feet.*
132	Forks—trails to Whatcom and to Fort Hope	49	25.8	120	51.1	5,722
133	Fort Hope trail, upper crossing of Similkameen, 120 miles above its mouth		23.8		54.5	4,028
134	Fort Hope trail, 6 miles west of Similkameen crossing and 6 miles from mouth of creek up which the trail runs		21.2	121	00.8	4,486
135	Summit of ridge, left bank of Similkameen, near upper crossing		23.7	120	55.3	4,750
136	Fort Hope trail, summit between two crossings of Similkameen		25.3		52.4	5,965
137	Camp on Fort Hope trail		29.4		47.5	4,906
138	On ridge south of valley of Similkameen		30.4		47.1	4,559
139	Encampement des Femmes, junction of trails to Forts Hope and Kamloops, 104 miles above mouth of Similkameen		31.5		45.2	2,506
140	Summit of ridge north of Encampement des Femmes		34.5		42.8	4,921
141	Summit of ridge on trail		27.2		35.5	4,085
142	Camp on creek 1 mile east of last summit, 1½ miles above mouth of creek, which is 90 miles above mouth of Similkameen		27.8		34.4	4,085
143	Camp on Similkameen 82 miles above its mouth and one-half mile below mouth of Pa-say-ten Creek		27.0		23.9	2,069
144	Summit of ridge on south side of Similkameen		21.6		24.5	4,041
145	Base of same ridge, crossing of Yakl-keh-whel-lich-ler (?), 11 miles above its mouth, which is 72 miles above mouth of Similkameen		21.5		23.9	2,580
146	Yan-set-ah-akwa Creek, 5 miles above its mouth, which is 81 miles above mouth of Similkameen.		31.2		24.9	2,379
147	Camp on Similkameen 64 miles above its mouth and 6 miles below Skai-shin Creek		21.3		05.2	1,919
148	Camp on Similkameen 52 miles above its mouth and 3 miles above mouth of Nais-nu-loh		14.5	119	59.9	1,477
149	Similkameen River, 49 miles above its mouth and just below mouth of Nais-nu-loh		18.1		56.8	1,455
150	Camp on Similkameen 36 miles above its mouth, in brushy bottom		09.5		43.8	1,406
151	Camp on northeast tributary of Similkameen 2 miles above mouth, the mouth 38 miles above mouth of Similkameen		11.7		42.5	2,248
152	Camp in flat near river, one-half mile above mouth of large creek coming from west, its mouth 31 miles above mouth of Similkameen		05.2		43.0	1,356
153	Camp on side of mountains, one-half mile north of creek coming from southwest, its mouth 26 miles from mouth of Similkameen		01.8		41.1	1,652
154	Summit of ridge bordering Similkameen River on west side		03.0		43.0	5,068
155	Camp Similkameen, 12 miles above mouth of Similkameen	48	59.2		34.9	1,164
156	Camp on Similkameen 1½ miles above mouth of Similkameen		55.5		25.0	904
157	Camp on Okinakane 11 miles below forks, 61 miles above mouth of Okinakane; 567 miles above mouth of Columbia		46.0		22.6	955
158	Lake Osoyoos, foot of (4 feet above water), 76 miles above mouth of Okinakane		57.0		24.2	957
159	Lake Osoyoos, camp on east side, 82 miles above mouth of Okinakane	49	02.4		25.0	953
160	Lake Osoyoos, north end of (inlet), 86 miles above mouth of Okinakane		04.5		29.2	931
161	Height of second plateau at foot of hills		13.1		32.3	1,633
162	....do		05.9		28.9	1,430

Elevations along the forty-ninth parallel, etc.—Continued.

No.	Station.	Latitude.		Longitude.		Elevation.
		°	′	°	′	*Feet.*
163	Summit of ridge, 3 miles east of Okin-á-kane River.	49	07.3	119	27.8	3,027
164	Summit of trail, Similkameen to Okinakane......		11.4		39.0	4,251
165	Lake Haipwil (2½ miles long by three-fourths mile wide)................	48	51.0		37.0	1,120
166	Summit of mountain, north of lake................		55.6		36.8	4,565
167	Camp on Haipwil Creek 3 miles above forks and 12 miles above its mouth..........................		47.0		37.9	1,376
168	Camp on Haipwil Creek one-half mile above forks and 9 miles above its mouth......................		48.9		38.0	1,366
169	On Haipwil where it enters couleé, 20 miles above its mouth..................................		40.8		39.1	1,643
170	Divide between Haipwil and Okinakane, near two lakes..................................		48.5		35.4	1,701
171	Summit of hill, Okinakane Valley................		45.1		23.6	2,487
172	Camp on Haipwil (West Fork) 8 miles above forks and 17 miles above mouth of Haipwil............		47.5		48.7	4,599
173	Summit of trail between a tributary of Che-wach (branch of Haipwil) and [Lake?] Methow, 20 miles from mouth of Haipwil and 5 miles from mouth of Che-wach..............................		46.2		52.0	6,854
174	West foot of ascent to summit.....................		45.9		52.6	6,220
175	On Che-wach at forks, 67 miles above mouth of Methow and 559 miles above mouth of Columbia.		47.8		57.5	3,296
176	Near mouth of tributary of west fork of Haipwil, 9 miles from forks of Haipwil...................		47.9		49.7	4,627
177	Large lake southwest of mouth of Similkameen, south end, 8 miles from Okinakane River.......		50.9		29.0	1,819
178	Smaller lake southwest of mouth of Similkameen, east side, 2 miles from Okinakane River.........		53.0		27.5	1,766
179	Summit of trail, Skagit to Pasayten.................	49	02.3	120	57.4	5,900
180	Saddle Divide, waters Skagit and Pasayten, 10 miles from mouth of Ne-po-pe-eh-kum Creek, which is 100 miles above mouth of Skagit and 24 miles from mouth of N'-shitl-shutl River.........		02.1		57.1	5,281
181	Summit Cache.......................................		01.9		56.5	5,594
182	First depression east of Summit Cache............		02.0		55.3	5,570
183	Third high point east of Summit Cache............		02.8		53.7	5,819
184	Summit to north of trail *a*........................		02.5		54.6	6,221
185	Summit near end of ridge...........................		03.0		50.0	6,233
186	First water below ridge on trail, 15 miles above mouth of N'-shitl-shutl, which is at Pasayten Cache..		03.2		48.6	3,860
187	Camp on N'-shitl-shutl 10½ miles above its mouth, at mouth of Chu-chu-wun-ten....................		03.5		42.9	3,431
188	Pasayten Cache, at mouth of N'-shitl-shutl, 24 miles above mouth of Pasayten, which is 82 miles above mouth of Similkameen.....................		09.6		33.6	3,194
189	Camp Pasayten, 36 miles from mouth of Pasayten.	48	59.7		32.2	3,676
190	First knoll on mountain east of Pasayten Cache...	49	08.7		32.0	4,880
191	Top of rocky slide near which trail passes on same mountain..		07.5		29.5	6,456
192	Camp on west slope of mountain..................		08.7		31.8	4,777
193	Elevation east of hill..............................		08.6		30.8	5,157
194	Camp..		07.5		28.8	4,701
195	Western principal summit..........................		07.5		25.5	6,433
196	Eastern principal summit...........................		07.8		23.5	6,455
197	Camp east and above tributary of Nais-nu-loh.....		08.2		22.2	6,494
198	Elevation 1½ miles east of above..................		08.3		21.6	6,170

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a To the north of this trail, in latitude 49° 03.7′, longitude 120° 53.5′, is another divide, between Ne-po-pe-eh-kum and N'-shitl-shutl, which is about 4,500 feet high. It is 11 miles from mouth of N'-shitl-shutl.

Elevations along the forty-ninth parallel, etc.—Continued.

No.	Station.	Latitude.		Longitude.		Elevation.
		°	′	°	′	*Feet.*
199	Camp on Nais-nu-loh, 18 miles above its mouth	49	08.8	120	15.1	3,568
200	Camp Nais-nu-loh Cache, 21 miles above mouth of Nais-nu-loh		07.2		17.3	3,678
201	Saddle between two principal summits, 26 miles above mouth of Nais-nu-loh		07.5		24.2	6,005
202	Camp on Nais-nu-loh, 7 miles above its mouth, at bend, mouth of creek		07.8		00.5	2,525
203	Camp on Nais-nu-loh, 5½ miles above its mouth, at trail crossing		09.1		00.2	2,171
204	On Nais-nu-loh, ½ mile above its mouth, where trail leaves it		13.1	119	57.4	1,515
205	Camp on southeastern tributary of Lake Osoyoos, 6 miles from its mouth, last trail crossing	48	59.5		16.4	3,092
206	Summit of trail, Lake Osoyoos to Ne-hoi-al-pit-kwu River	49	00.6		11.8	4,068
207	Highest terrace east of summit		01.1		09.8	3,476
208	Fourth terrace east of summit, just before descending to valley of Rock Creek		02.6		05.4	3,032
209	First crossing of Rock Creek, 6 miles above its mouth		02.7		05.2	2,762
210	Fourth terrace, just after ascending from valley of Rock Creek		02.8		04.9	3,101
211	Upper terrace above town [? Twai-yeep] on Rock Creek, just before descending to Ne-hoi-al-pit-kwu River		03.2	118	59.0	2,366
212	Upper camp on Ne-hoi-al-pit-kwu, 80 miles above its mouth, at mouth of Rock Creek		03.2		58.7	2,153
213	Camp Ne-hoi-al-pit-kwu, 66 miles above its mouth (20 feet above water)	48	59.1		44.5	1,826
214	On Ne-hoi-al-pit-kwu River, 44 miles above its mouth	49	00.4		23.4	1,663
215	Camp Statapoostin, 36 miles above its mouth		00.2		16.3	1,636
216	En-cháhm Lake, outlet of, 1½ miles from Ne-hoi-al-pit-kwu River, at a point 32 miles from its mouth		02.1		12.7	1,531
217	Camp on Ne-hoi-al-pit-kwu, 29 miles from its mouth	48	59.4		12.5	1,468
218	Camp on Ne-hoi-al-pit-kwu, 16 miles from its mouth		50.5		10.4	1,466
219	Camp on Ne-hoi-al-pit-kwu, 9 miles from its mouth		46.3		06.8	1,226
220	Camp on Ne-hoi-al-pit-kwu, 1 mile from its mouth		40.9		06.5	1,271
221	Camp on Ne-hoi-al-pit-kwu, at mouth, 746 miles from mouth of Columbia		40.0		06.2	1,252
222	Columbia River crossing, 1 mile below Kettle Falls (20 or 25 feet high), 782[a] miles above its mouth		36.8		07.5	1,202
223	Columbia River camp (25 feet above river), 766 miles above its mouth		51.6	117	53.9	1,341
224	Camp Columbia (58 feet above water now nearly at lowest stage), 783 miles above its mouth		59.8		37.7	1,317
225	Camp Columbia (another measure)					1,514
226	Camp on summit on trail westward from Camp Columbia		58.6		45.4	3,41
227	Camp on tributary of Yóme-tsin, 4 miles from Yóme-tsin's mouth, which is 775 miles from mouth of Columbia		58.1		48.1	2,16
228	High point on trail		58.9		49.5	4,65
229	Camp		58.0		58.7	2,68
230	Summit on trail, divide between Yome-tsin and Ne-hoi-al-pit-kwu		57.7	118	02.9	4,73
231	Camp on tributary of Ne-hoi-al-pit-kwu, 5 miles above its mouth, which is 28 miles above mouth of Ne-hoi-al-pit-kwu		57.2		07.0	3,36

[a] Apparently an error for 742.

Elevations along the forty-ninth parallel, etc.—Continued.

No.	Station.	Latitude.		Longitude.		Elevation.
		°	′	°	′	*Feet.*
232	High point on trail east of divide	48	57.8	118	02.0	4,707
233	Crossing Creek, 3 miles east of camp—first plateau, 2 miles above mouth of creek, which is 59 miles above mouth of Okinakane		43.7	119	19.2	1,383
234	Crossing Creek, 5 miles east of camp—second plateau, 6 miles above mouth of Kwahaloose Creek, which is 57 miles above mouth of Okinakane River		42.1		15.2	2,156
235	Divide between Kwahaloose Creek and large eastern tributary [Lower Bonaparte of Arrowsmith's map] of Okinakane River		40.6		13.7	3,350
236	Camp on first large branch of Lower Bonaparte River, 3 miles above mouth of branch and 12 miles above mouth of river		39.6		08.2	2,563
237	Divide between 2 branches of Lower Bonaparte River and a southern tributary of the Ne-hoi-al-pit-kwu River; 11 miles above mouth of first branch, which is 12 miles above mouth of second branch, which is 33 miles above mouth of Lower Bonaparte River and 22 miles from mouth of southern tributary of Ne-hoi-al-pit-kwu River, which is 63 miles above mouth of that river		41.3	118	58.3	4,312
238	Camp on second branch of Lower Bonaparte River, 9 miles above its mouth		40.7		54.7	3,531
239	Camp on second branch of Lower Bonaparte River, 3 miles above its mouth		38.7		47.8	2,459
240	Summit of ridge north of No. 238=average height of mountains in vicinity		41.0		56.6	5,230
241	Crossing of Lower Bonaparte, 38 miles above its mouth		38.7		39.9	2,746
242	Divide between Okinakane and Columbia, 45 miles from mouth of Lower Bonaparte and 19 miles from the Columbia, at a point 739 miles from its mouth		37.9		32.3	5,662
243	High point north of trail on divide between Okinakane and Columbia		39.2		33.1	7,065
244	Camp No. 3, on Columbia River *a*	48	37.0	118	06.9	1,307
245	Camp No. 2, on Columbia River					1,622
246	Summit of ridge bordering Colville Valley to north					3,017
247	Camp No. 1, on Peptashin Creek near mouth					1,585
248	Summit of ridge=average height of ridges in vicinity					3,715
249	Camp No. 15, Peptashin Creek near town					1,957
250	Colville depot, at observatory					1,963
251	Camp No. 1, Mill Creek near Colville depot					1,658
252	Lake 5 miles southeast of Colville depot					2,153
253	Summit of mountain west of Colville depot					3,330
254	Summit of mountain 6 miles east of Colville depot					5,697
255	Camp No. 2 on Mill Creek near Stugar's farm					1,629
256	Mountain east of Camp No. 2					4,890
257	Mountain south, on same ridge, and north of Francois' house					4,086
258	Camp No. 3, near Francois' farm					1,717
259	Mountain southwest of Francois', near trail					3,136
260	On branch of Mill Creek, at crossing of trail, 5 miles south of Francois', An-i-aht-wa or Oit-chin Prairie					1,765
261	Crossing of first stream south of Hughes ranch on wagon road					1,754
262	On wagon road between Colville and Spokane at small ponds					2,119
263	On head of small lake, east end, near wagon road					1,970

a Second cahier begins here.

Elevations along the forty-ninth parallel, etc.—Continued.

No.	Station.	Latitude.	Longitude.	Elevation.
		° ′	° ′	*Feet.*
264	Highest point on Colville wagon road			4,083
265	Chemakane bridge, junction of trail and wagon road			1,922
266	Summit of trail between Mill Creek and Little Spokane			2,735
267	Walker's Prairie, on small branch of Chemakane			1,897
268	Mouth of Chemakane—approximate			1,366
269	Summit of trail, short cut between Chemakane and Spokane			2,809
270	Trail at northernmost bend of Spokane River, 18 miles below mouth of Little Spokane *a*			1,500
271	On plateau above Spokane River, 7 miles below mouth of Little Spokane			1,854
272	On edge of Spokane River, 7 miles below mouth of Little Spokane			1,558
273	Little Spokane, mouth of, at water's edge			1,685
274	Summit of hill, northeast of mouth of Little Spokane			3,140
275	On little Spokane, near crossing of trail			1,609
276	On plateau south of crossing			1,760
277	On plateau of Spokane River			1,878
278	Hill in bend of Little Spokane, about 5 miles from mouth			2,355
279	On edge of plateau south of trail			2,266
280	On Spokane River, water's edge, near Plant's			1,901
281	On plateau north of Plant's			2,375
282	Plant's house			2,06
283	Trail to Sinyakwateen, 11 miles from Plant's			2,228
284	Trail on Spokane, 3¼ miles below lake [Cœur d'Alene]			2,185
285	Cœur d'Alene Lake			2,151
286	Hill near lake, south of trail			2,499
287	On small lake north of Cœur d'Alene Lake			2,205
288	On summit of spur bordering lake			2,862
289	Average height of rolling country north and northeast of lake			3,170
290	Plateau north and east of trail to Mission			2,767
291	Creek 3¼ miles east of arm of lake [Cœur d'Alene]			2,121
292	Plateau north of creek crossing			2,681
293	Shore of large lake south of Checolsum Mountain			2,262
294	Point on mountain spur between lakes			3,577
295	Trail to Sinyakwateen, 19 miles from Plant's			2,200
296	Little knoll 5 miles beyond and west of road			2,885
297	Tesemmeus lakes, [? Tesimini]			2,322
298	On edge of plateau 3 miles east of road			2,540
299	Top of plateau on road 4 miles south of Pekowla Lake			2,539
300	Bottom of plateau			2,333
301	On Pekowla Lake			2,200
302	Sinyakwateen depot, right bank of Clark Fork of the Columbia River			2,084
303	Vermilion Creek, mouth of fall of Clark Fork from [Pend Oreille] lake to falls about 0.44 foot per mile; falls about 5 feet			2,074
304	Checolsum Mountain			5,706
305	Crossing of trail near forks of creek north of Checolsum Mountain			2,455

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a From the northernmost bend to mouth of Spokane the average fall is about 9 feet per mile.

Elevations along the forty-ninth parallel, etc.—Continued.

No.	Station.	Latitude.	Longitude.	Elevation.
		° ′	° ′	*Feet.*
306	Crossing of tributary of Little Spokane. Little Spokane has an average fall of about 15 feet per mile			1,880
307	Lake on Little Spokane			1,947
308	Trail north of lake			2,093
309	On plateau above Little Spokane			? 2,441
310	On high plateau on trail			2,356
311	Lake at head of Little Spokane			2,237
312	Trail between Spokane and Clark Fork Divide			2,335
313	Clark Fork at outlet of Pend Oreille Bay			1,942
314	Clark Fork 8 miles below falls			2,[illegible]
315	Clark Fork 4 miles above Mission			1,957
316	Clark Fork at mouth of Skomin Creek			1,926
317	St. Ignatius Mission			1,894
318	Skomin Creek, 5 miles above mouth			2,769
319	Skomin Creek, 9 miles above mouth			2,901
320	Skomin Creek, 11 miles above mouth			3,736
321	Divide between Skomin and Chelonscan creeks			4,199
322	Mountain 1½ miles south of divide			5,218
323	2 miles below divide on eastern slope			3,438
324	Trail from Mission to Kaniksu Lake, 7 miles			3,041
325	Crossing of creek, 12 miles from Mission			3,585
326	Trail above and beyond crossing of creek			3,640
327	Teh-kwat Mountain, north of trail			5,770
328	Water on Teh-kwat Mountain, south of trail			5,443
329	Crossing of first creek east of divide			2,740
330	Creek 5 miles west of lake			2,606
331	Kaniksu Lake			*a*2,443
332	Upper Kaniksu Lake			*a*2,435
333	On creek, 2 miles above Upper Lake			2,469
334	Long bridge on trail from Sinyakwateen to Chelemta, 6 miles			2,086
335	Clark Fork, 14 miles above Sinyakwateen			2,089
336	Kalispelm Lake			2,095
337	Pack River crossing			2,101
338	Divide between Pack and Kootenay rivers			2,188
339	Small lake west of trail and north of divide			2,090
340	Trail in forks of creek			2,064
341	Chelemta depot			1,796
342	Kootenay River, 18 miles below Chelemta			1,802
343	Crossing of Acklew Creek			2,248
344	Acklew Cache			2,304
345	Camp Kootenay West (about 50 feet above water)			1,823
346	Mountain N. 42° E. from Camp Kootenay West			5,573
347	Trail from Chelemta to Acklew, 8 miles, first water			2,695
348	Trail from Chelemta to Acklew—10½ miles			2,694
349.	Trail from Chelemta to Acklew—14 miles—crossing of stream			2,557
350	Trail from Chelemta to Acklew—17 miles—grassy mound			2,548
351	Trail from Acklew to Mooyie—1 mile—divide on trail			3,260
352	Trail from Acklew to Mooyie—3 miles—divide			2,985

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[a] The contradiction here by which the upper lake level is less than the lower one is noted in the original MS., but not corrected.

Elevations along the forty-ninth parallel, etc.—Continued.

No.	Station.	Latitude.	Longitude.	Elevation.
		° ′	° ′	*Feet.*
353	Trail from Acklew to Mooyie—3½ miles—head of Ar-ka-klu-ne [a] Creek	....	....	2,882
354	Trail from Acklew to Mooyie—8 miles—prairie	....	....	2,638
355	Trail from Acklew to Mooyie—13 miles—creek crossing	....	....	2,798
356	Trail from Acklew to Mooyie—terrace south of crossing	....	....	2,811
357	Trail from Acklew to Mooyie—lower crossing of Ar-ka-klu-ne	....	....	2,678
358	Trail from Acklew to Mooyie—terrace above	....	....	2,756
359	Trail from Acklew to Mooyie—crossing of Mooyie	....	....	2,682
360	Camp Mooyie	....	....	2,689
361	Mooyie Cache	....	....	2,742
362	Mountain ridge east of Camp Mooyie	....	....	6,639
363	Summit of ridge	....	....	6,698
364	Same ridge 8 miles south	....	....	4,466
365	Crossing of Mooyie 8 miles below Camp Mooyie	....	....	2,142
366	Second crossing of Mooyie, from cache (14 feet above water)	....	....	2,718
367	Fourth crossing of Mooyie, from cache	....	....	2,850
368	Sixth crossing of Mooyie, from cache	....	....	2,934
369	7 miles from sixth and 2½ miles from seventh crossing	....	....	2,940
370	Seventh crossing at foot of lake (3 feet above water)	....	....	3,029
371	Terrace east of seventh crossing—on trail	....	....	3,291
372	First stream—2½ miles beyond seventh crossing of Mooyie	....	....	3,067
373	Second stream—9½ miles beyond seventh crossing of Mooyie	....	....	3,766
374	Third stream—10½ miles beyond seventh crossing of Mooyie	....	....	3,514
375	11 miles from seventh crossing, north of lakes	....	....	3,136
376	Headwaters of Mooyie, 13½ miles from seventh crossing	....	....	3,296
377	Terrace near headwaters of Mooyie	....	....	3,383
378	South and near divide between Mooyie and Kootenay	....	....	3,544
379	Divide between Mooyie and Kootenay	....	....	3,642
380	Joseph's Prairie	....	....	2,959
381	Crossing of stream [Akis-ka-klail] south of Joseph's Prairie	....	....	3,041
382	Kootenay River northeast of Joseph's Prairie	....	....	2,451
383	Crossing of first creek going down the Kootenay [b]	....	....	2,682
384	Crossing of second creek going down the Kootenay—10 miles beyond	....	....	2,679
385	Crossing of third creek going down the Kootenay	....	....	2,619
386	Crossing of fourth creek going down the Kootenay	....	....	2,741
387	Creek 9 miles beyond	....	....	2,420
388	Prairie on Kootenay—25 miles above Camp Kootenay East	....	....	[c] 2,400
389	Prairie on Kootenay—10 miles above Camp Kootenay East	....	....	2,364
390	Kootenay River—6 miles above Camp Kootenay East	....	....	2,361
391	On creek—5½ miles north of Camp Kootenay East	....	....	2,401
392	Camp Kootenay East (30 feet above water)	....	....	2,348

[a] Also written Acaclunah.

[b] The fall of Kootenay River for about 30 miles south from latitude 49° 35′ N. is 2 feet per mile.

[c] At bend of Kootenay River above mouth of Elk River computed height is 2,381 feet. The fall of the Kootenay for about 20 miles from above mouth of Elk River south is 4½ feet per mile.

Elevations along the forty-ninth parallel, etc.—Continued.

No.	Station.	Latitude.	Longitude.	Elevation.
		° ′	° ′	*Feet.*
393	Camp Kootenay East—at water			2,315
394	South of Camp Kootenay East (3 feet above water)			2,313
395	Kootenay River 2½ miles below camp (3 feet above water)			2,300
396	Kootenay Cache			2,316
397	First bench above river			2,368
398	Second bench above river			2,506
399	First creek south of Kootenay Cache			2,355
400	Trail on Tobacco Plains, highest point south of cache			2,755
401	Creek 9 miles from cache			2,691
402	Entrance of Akonoho Pass			3,015
403	11 miles from entrance and 3 miles from summit of pass			4,195
404	2½ miles west of summit			4,460
405	One-half mile west of summit			5,138
406	Divide between Kootenay and Flathead rivers			5,218
407	On divide, one-half mile north of pass			6,963
408	On spur of divide, 2 miles north of pass			6,278
409	Divide between Wigwam and Akonoho			5,332
410	Wigwam Station			4,694
411	Small prairie one-half mile east of summit of pass			5,066
412	Four miles east of summit of pass (65 feet above water)			4,731
413	Crossing of stream, 7½ miles east of summit			4,522
414	Prairie, 12 miles east of summit			4,164
415	Large creek down which trail follows (water of Yakinikak creek opposite Prairie)			4,112
416	Flathead valley, upper terrace			4,267
417	Peak west of Flathead			7,373
418	Crossing of Flathead			3,827
419	1½ miles beyond crossing, in Prairie			3,763
420	Camp Kishenehn, 4 miles to mouth of Kishenehn—fall 58 feet per mile			4,134
421	Three miles above Camp Kishenehn (3 feet above water)—fall 63 feet per mile			4,252
422	Prairie, 8 miles above Kishenehn—fall 58 feet per mile			4,541
423	Angle of valley, 12 miles above—fall 36 feet per mile			4,705
424	Angle of valley, 2½ miles above this angle			4,806
425	Open place in burnt timber			5,133
426	Mule camp			5,191
427	Summit of pass, 9 miles from angle, 21 miles from Camp Kishenehn and 25 from mouth of creek			5,846
428	Near outlet of lake east of summit			5,407
429	1½ miles east of summit, on creek			5,378
430	Camp Akamina			6,447
431	On divide north of summit monument			7,986
432	Bluff SE. of Camp Akamina			6,648
433	Summit monument			*a* 7,490
434	Mountain in divide 1½ miles N. of pass			8,087
435	Mountain in divide 1 mile NE. of last			8,207
436	Mountain in divide one-half mile N. of last			8,313
437	Mountain in divide 2½ miles NE. of last			8,333

a Another value given in the table, and without comment, is 6,548. Can this be an error for 7,548?

Elevations along the forty-ninth parallel, etc.—Continued.

No.	Station.	Latitude.	Longitude.	Elevation.
		° ′	° ′	*Feet.*
438	Summit of Boundary Pass			6,955
439	Mountain, 1¼ miles north of pass			7,861
440	Kishenehn Mountain			*a* 8,487
441	Mountain up pass and to the north			*a* 7,409
442	Kishnenehna Mountain, north and west peak			*a* 7,937
443	Kishnenehna Mountain, center peak			*a* 8,170
444	Kishnenehna Mountain, south and east peak			*a* 9,187
445	Divide 2 miles east of Camp Kishenehn			5,541
446	In valley of creek west of camp and north of boundary			5,119
447	Boundary Mountain, highest peak			8,574
448	Southwest point of ridge of Boundary Mountain			7,260
449	Kootenay River, 3 miles below parallel			2,303
450	Kootenay River, 17 miles below parallel			2,256
451	Kootenay River, 33¼ miles below parallel			2,204
452	Kootenay River, 39 miles below parallel			2,184
453	Kootenay River, 50 miles below parallel at crossing of trail			2,148
454	Kootenay River, 13 miles below crossing (8 feet above water)			2,057
455	Kootenay River, 25 miles below crossing; below falls, at high-water mark			1,967
456	Kootenay River, 39 miles below crossing; mouth of the Yahk			1,934
457	Kootenay River, 44 miles below crossing; terrace above river			2,298
458	Forage cache on trail 13 miles from Yahk			2,161
459	Camp on terrace on trail 3 miles east of Mooyie Crossing			2,260
460	Kootenay River, 55 miles below crossing; mouth of Mooyie			1,792
461	Kootenay River, 61 miles below crossing; Chelemta depot (9¼ feet above high water)			1,796
462	Summit of mountain range between waters of Wigwam River and Skits-ooh-nau-na Creek			7,852
463	Camp in forks of tributary of Tobacco River			3,256
464	Camp on west side of Kootenay Valley			2,942
465	Camp on waters of Kootenay, near divide with Yahk			4,862
466	Summit of divide between Yahk and Kootenay			5,498
467	Camp west of divide			5,520
468	.....do			4,954
469	Camp on mountain, tributary of Yahk			4,794
470	Camp on east fork of Yahk			3,483
471	Camp in forks of Yahk			3,194
472	Camp at east bend of Yahk			2,983
473	Camp on Yahk			2,959
474	Camp at west bend of Yahk			2,935
475	Camp on Yahk			2,759
476	.....do			2,697
477	Camp below falls			2,414
478	Camp at mouth of Yahk			1,926

a Measured with theodolite.

INDIAN NAMES.

In the prosecution of the survey considerable attention was given to the language of the native tribes along the line. George Gibbs, who accompanied the party, is referred to in various capacities as geologist, ethnologist, guide, interpreter, and naturalist. The first Chinook dictionary is said to have been prepared by him, and this was to form a part of the final report of the survey. Later Mr. Gibbs was engaged by the Smithsonian Institution in elaborating linguistic material from the tribes of the Northwest. This work was unfinished at the time of his death in April, 1873. Some of it has been published since. To secure uniformity in the spelling of the names of various camps and stations Mr. Gibbs prepared lists which were submitted to General Parke and made official. There are three such lists among the papers. The first two are signed; the third is not signed. The first list is as follows:

Adopted spelling of the names of camps, etc.

[Official: John G. Parke, chief astronomer and surveyor.]

Chiloweyuck.
Chuch-che-hum.
En-saaw-kwatch.
Fraser.
La-yome-sin.
Nooksahk.
Okinakane.
Pehosie.
Semiahmoo.
Sen-eh-say.
Similkameen.
Skagit.
Sumass.
Swehl-tcha.
Tummeahai.

The three lists have been combined, arranged, studied in company with the published maps of the boundary and later official maps. The results are here given with notes derived from such comparison and study. For easy reference on the maps the approximate longitudes are given.

	Approximate longitude.	
	°	'
A-kám-i-na;[1] east fork of Kish-e-nehn Creek	114	10
A-kin-ís-sahtl; Flathead River	114	30
A-kin-kwo-náh-ki;[2] branch of Flathead River heading with Tobacco River	114	30
Ak-káph-kleh; falls of the Kootenay River, Flathead County, Montana	115	45
Ak-o-nó-ho; creek tributary to Tobacco River[3]	115	05
Ak-swák; creek from south at bend of the Kootenay[4]	115	15

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[1] Kam-i-na=watershed.

[2] Perhaps this is Yokinikah Creek of the Land Office map of Montana.

[3] Tobacco River=Grave Creek of Land Office map of Montana.

[4] Not named on boundary map; apparently Fisher Creek of Land Office map of Montana, and Masula River of official map of British Columbia, 1895.

	Approximate longitude.	
	°	′
Ak-tlak-a; creek above Kish-e-nehn, tributary to Flathead River. Not named on boundary map	114	25
A-kwote-kátl-nam; Chief Mountain or Waterton Lake, upper part across boundary	114	
An-i-áht-wha; Kamass Prairie	......	
Che-chéet-hu; Skagit cache	121	05
Chelemta (also written Cholemta); cache or depot. Not shown on map or identified. (See Swoots-kóse and Yah-kwoo-káh-keh)	116	20
Che-loús-kan; Little Pend Oreille	116	40
Chém-a-kane; bridge over Walkers Prairie Creek	116	46. 4
Chiloweyuck; camp, lake, river, town, etc. Now written Chilliwhack	121	30
Chow-a-wee-la; Fool's Prairie. Not identified.	......	
Chuk-kóse; the Mooyie Lakes. Not shown on map. In British Columbia, latitude 49° 18′	115	50
Chuch-che-hum; camp and creek tributary to Chiloweyuck Lake	121	15
Chu-chu-wán-ten; creek tributary to N'shitl-shootl River, which is tributary to Pa-say-ten	120	40
En-cháhm;[1] lakes near Statapoostin	118	13
En-kwool-eh-la; mouth of Clark forkof the Columbia. Name not on boundary map	117	37
En-saaw-kwatch;[2] station and creek tributary to the Chiloweyuck	121	30
Háip-wil;[3] lake near camp Similkameen	119	37
Hó-zo-meen; mountain near camp Skagit	121	
In-chú-in-tum;[4] station and river tributary to the Ne-hoi-al-pít-kwu	118	25
Ka-cha-átl; Indian village Aklew (or Acklew) cache	116	22
Kái-seet-lin; crossing of Spokane. Not identified.		
Kais-in; branch of Kat-láh-woke Creek. Not on map and not identified.		
Kal-is-pelm; Pend Oreille Lake in northern Idaho	116	30
Kam-i-na=a watershed.		
Kat-láh-woke; creek running to Flathead [river] through [Boundary] pass; not named on boundary map and not identified. It is near Kísh-e-nehn Creek	114	20
Ka-yak-ka;[5] creek, from south, tributary to Kootenay below falls; large lake on it	115	50
Kin-nook-kleht-nán-na;[6] creek running east from divide [of Rocky Mountains] to [Chief Mountain or Waterton] lake	113	50

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[1] Christina Lake of official map of British Columbia, 1895.

[2] Written En-saw-kwatch on boundary map and on above map called Nesquatch.

[3] Harpwil of British Columbia map of 1895 and Blue Lake of Land Office map of Washington.

[4] North fork of Kettle River of British Columbia map of 1895. Also Inishwointon in the manusc notes.

[5] Lake Creek of Land Office map of Montana.

[6] Kotanie River of official map of British Columbia, 1895.

	Approximate longitude.	
	°	′
Kínt-la; lake and mountains, Flathead County, Montana	114	15
Kísh-e-nehn; camp, creek, and mountain	114	20
Kish-ne-néh-na; mountains	114	15
Kit-lat-laá-nook; creek heading east of Mount Wilson and emptying into lower [Chief Mountain or Waterton] lake	113	50
Kle-síl-kwu;[1] creek tributary to upper Skagit, heading with Klehkwunum	121	15
La-yome-sin;[2] creek, tributary to the Chiloweyuck	121	54
Man-sel-pán-ik;[3] creek, tributary to Kle-sil-kwu Creek, heading with Chuch-che-hum	121	15
Moo-yie;[4] camp, monument, river, and trail	116	15
Náís-nu-loh; station and river, south fork of Similkameen	120	
Ne-hoi-al-pít-kwu;[5] camp and river	118	30
Ne-pó-pe-éh-kum; creek, tributary to the upper Skagit	121	
Nook-sahk; river, Whatcom County, Washington. Now written Nooksak	122	15
N'-shitl-shootl;[6] creek, tributary to Pa-say-ten River	120	40
Okin-á-kane, now written Okanogan; county and river tributary to the Columbia	119	30
O-só-yoos; camp, lake, and station	119	25
Pa-sáy-ten;[7] river tributary to Similkameen	120	30
Pehosie, or Pekosie; lake and creek tributary to the Nooksak	122	05
Pep-táh-shin; creek at [Colville?] depot	118	
Sah-lílt-kwu; the forks [of ?]. Not identified. Name not on boundary map.		
Se-háí-uks; the creek [at Archer's camp of October 10]. Not identified.		
Se-háí-ya-kan; Archer's camp of October 10. Not identified.		
Semiahmoo; bay and camp near western end of parallel	122	45
Sen-eh-say;[8] station and creek, tributary to the Chiloweyuck	121	40
Sháh-wa-tum; mountain on upper Skagit	121	
Shwo-yél-pi; Kettle Falls of the Columbia	118	10
Si-míl-ka-meen; camp and river tributary to the Okanogan	119	30
Sin-páíl-hu;[9] creek running south to the Columbia	?118	10
Skagit; cache, camp, county, and river, Washington	122	

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[1] Klesilkwa of official map of British Columbia, 1895.

[2] Written Layomesin on boundary map. Sweltzer River of official map of British Columbia, 1895.

[3] Maselpanic, of official map of British Columbia, 1895.

[4] The river is now known as Methow.

[5] Kettle River, of official map of British Columbia, 1895.

[6] Roche River, of official map of British Columbia, 1895.

[7] Pasayton, of official map of British Columbia, 1895.

[8] Slesse, of official map of British Columbia, 1895.

[9] Not shown on boundary map. Land Office map of Washington has Sinpailhu, or Milk Creek (long. 118° 10′), just below Kettle Falls; also San Poil River and guide meridian. This latter is Sans Poil of official map of British Columbia, 1895.

	Approximate longitude.	
	°	′
Skits-ooh-nán-na; small creek tributary to the Kootenay; not shown on boundary map	115	05
Skwái-kwi-éht; mountain at head of Chu-chu-wán-ten Creek.	120	40
Stat-a-poós-tin; camp on the Ne-hoi-al-pít-kwu	118	15
Stle-kéhm; Mill Creek [? near old Fort Colville, longitude 117° 40′].		
Sumass, now usually written Sumas; camp, lake, town, etc	122	10
Swehl-tchá;[1] lake in British Columbia	122	
Swoots-kóse; the Chelemta cache [not on boundary map]. See Yah-kwo-káh-keh.		
Tcho-páhk;[2] mountain west of Camp Similkameen	119	45
Te-kum-whéhl-tin; Archer's camp of October 9; not identified		
Tummeahai;[3] camp and creek tributary to the Chiloweyuck	121	45
Twáí-yeep; upper forks of Ne-hoi-al-pít-kwu[4]	119	
Wáí-haist; mountain on Upper Skagit; not named on boundary map	121	
Yah-kwoo-káh-keh; the Chelemta cache. See Swoots-kóse. Not identified.		
Yahk;[5] station and river, Flathead County, Montana	115	45
Yak-ín-ȧ-kahk;[6] creek and pass	114	30
Yakl-tó-le-min; mouth of Pa-say-ten River; not named on boundary map	120	35
Yaks-koo-nák-he;[7] first creek from north below bend of Kootenay	115	30
Yak-toók-i-na;[8] third creek from north tributary to Kootenay, below bend	115	45
Yóme-tsin;[9] White Sheep Creek, tributary to the Columbia	117	50

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[1] Cultus of official map of British Columbia, 1895. A creek near by is called Sweltzer.

[2] Tcho Park Mountains of Land Office map of Washington.

[3] Tamihy of official map of British Columbia, 1895.

[4] Apparently junction of Rock Creek and Ne-hoi-al-pit-kwu.

[5] Yahk'h on boundary map.

[6] Yak-in-i-kak on boundary map and Yokinikah of Land Office map of Montana.

[7] Ramy Creek of Land Office map of Montana.

[8] Quartz Creek of Land Office map of Montana.

[9] Sheep Creek of official map of British Columbia, 1895, and Yometsin or Sheep Creek of Land Office map of Washington.

SCIENTIFIC RESULTS.

In the conduct of the survey attention was given to the geology, natural history, etc., of the region traversed. Mr. George Gibbs was attached to the survey as geologist and interpreter, C. B. R. Kennerly as surgeon and naturalist, and James M. Alden as artist. Collections were made and forwarded to Washington. These collections were placed in the hands of specialists, who prepared reports thereon. The nature and extent of these collections can be inferred from the report of the Auditor of the Treasury, already referred to.

It appears from that report that about $3,500 was expended on the preparation of reports on scientific subjects. The persons who prepared those reports, the subjects reported on, and the sums paid are set forth in the following table.[1]

Amounts paid during 1861–62 for work done in the preparation of the scientific part of the final report.

J. S. Harris, report on magnetics, with computations, etc	$743.50
F. B. Meek, report on fossil mollusks, with drawings	375.00
Theodore Gill, report on fishes	300.00
William Stimpson, report on crustaceæ and marine invertebrates	300.00
George Suckley, report on salmonidæ, ornithology, and mammals	300.00
P. B. Carpenter, report on recent mollusks	250.00
J. S. Newberry, report on fossil plants	150.00
Elliot Coues, report on birds, etc	100.00
John Torrey, report on botany	100.00
P. R. Uhler, report on insects	25.00
J. H. Richard, drawings for natural history reports	463.00
John Cassin, eight natural history drawings on stone	160.00
W. B. McMurtrie, drawings for geological reports	100.00
T. Y. Gardner, drawings of fossil plants	65.00
Thomas Egleston, jr., analysis of mineral specimens and preparing catalogue.	50.00
Mary B. Codwise, copying natural history papers	12.90
Total	3,494.40

That the reports on these various topics were prepared for insertion in the final report of the commission is abundantly proved. Mr. George Suckley, M. D., assistant surgeon, United States Army, read before the New York Lyceum of Natural History, in June, 1861, a paper entitled "Notices of certain new species of North American salmonidæ, chiefly in the collection of the Northwest Boundary Commission, in charge of Archibald Campbell, esq., commissioner of the United States, collected by Dr. C. B. R. Kennerly, naturalist to the commission."[2] In this paper he says: "Owing to the unfortunate death of Dr. Kennerly on his return from a three-years' exploration, the preparation of a report on certain of the material collected by him was assigned to me. In the course of this undertaking I have prepared a copious synopsis of the species of American salmon and trout, *to appear in the final report of the commissioner*. It has been thought best to issue in advance brief descriptions of the species hitherto unnamed." And later he alludes to papers "to be referred to in the more extended report."

Some of the fossils collected were described by Mr. F. B Meek,[3] who says, "The fossils described in this paper are the new species contained in the collections of the Northwestern Boundary Survey.

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[1] House Ex. Doc. No. 86, Fortieth Congress, third session, p. 101.

[2] Annals Lyceum Nat. Hist. New York, vol. 7, pp. 306–313, 1862.

[3] Proc. Acad. Nat. Sci. Phil., vol. 13, pp. 314–318, 1861.

Full illustrations and more extended descriptions of these and other species formerly described by the writer, from Vancouver Island, *will appear in the report of that survey*, which will also contain a report by Mr. George Gibbs, geologist of the expedition, on the general geology of the country along the boundary line."

This full report by Mr. Meek is, so far as I know, still unpublished. Dr. J. S. Newberry's report on the fossil plants seems, however, to have been published in full. At all events, he read, before the Boston Society of Natural History, on October 1, 1862, a paper entitled[1] "Descriptions of the fossil plants collected by Mr. George Gibbs, geologist to the United States Northwest Boundary Commission, under Mr. Archibald Campbell, U. S. Commissioner." This paper, published in February, 1863, "by permission of Archibald Campbell, esq., U. S. commissioner, Northwest Boundary Commission," makes no reference to any other or fuller report. The artist, Mr. James M. Alden, produced a fine series of colored sketches of scenery along the boundary line. These sketches, obviously intended to illustrate the final report, are in the State Department. There are 65 of these, all but two (large ones) included in three portfolios. These sketches and the constantly recurring allusions to the final report, and the conclusive proof that such report was prepared, sharpen the desire and emphasize the need of recovering it.

Whether the geologic report of Mr. Gibbs, alluded to by Mr. Meek, was ever published does not appear. It may be that the rather extensive paper entitled "Physical geography of the northwestern boundary of the United States, by George Gibbs, with twelve illustrations," read before the American Geographical Society November 11, 1869, and published in its journal (vol. 4, pp. 298–392, and vol. 5, pp. 134–157), is the report referred to.

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[1] Boston Jour. Nat. Hist., vol. 7, pp. 506–524, 1863.

APPENDIX A

MODE OF DETERMINING POINTS ON THE PARALLEL

The following is the agreement as to method of determining poin on the parallel by measures from the tangent. This agreement a the accompanying table are copied from the original in the Sta Department.

TO DETERMINE POINTS ON THE FORTY-NINTH PARALLEL BY MEANS OF THE TANGENT.

Wherever points of the parallel between the astronomical stations are to be dete- mined it is hereby agreed to adopt the method of offsets from the tangent t parallel.

For computing the length of these offsets the following formula is adopted, b that used in computing the difference of latitude of points in secondary triangl those whose sides do not exceed 12 miles in length:

$$-dL=kB\cos Z+k^2C\sin^2 Z+h^2D$$

where

dL=difference of latitude of the two points;

k=length of side connecting them;

$$B=\frac{1}{R\text{ arc }1''};$$

$$C=\frac{\tan L}{2NR\text{ arc }1''};$$

$$D=\frac{\frac{3}{2}e^2\sin L\cos L\text{ arc }1''}{(1-e^2\sin^2 L)^{\frac{3}{2}}};$$

$h=kB\cos Z$;

$$R=\frac{a(1-e^2)}{(1-e^2\sin^2 L)^{\frac{3}{2}}};$$

$$N=\frac{a}{(1-e^2\sin^2 L)^{\frac{1}{2}}};$$

a=equatorial radius of the earth=6 974 127.31 yards;

e=eccentricity=0.081 696 830;

Z=azimuth of tangent counting from south around by west; whe west=90°, east=270°.

This formula becomes in the present case

$$-dL=k^2C;$$

or, taking offset in yards=δ, distance in yards on the tangent=D

$$\log\delta=2\log D+2.915491.$$

Jno. G. Parke,
Lieutenant, Corps Topographical Engineers U. S., Chief Astronomer and Surveyor.
R. W. Haig,
Captain, R. A., Astronomer British Commission.

Camp Simiahmoo, *Forty-ninth Parallel, April 23, 1859.*

Miles.	Offsets.			Miles.	Offsets.		
	Yards.	Feet.	Inches.		Yards.	Feet.	Inches.
0.25	0	0	0.57	5.25	7	0	1.00
.50	0	0	2.29	.50	7	2	1.68
.75	0	0	5.16	.75	8	1	3.49
1.00	0	0	9.18	6.00	9	0	6.45
.25	0	1	2.34	.25	9	2	10.57
.50	0	1	8.65	.50	10	2	3.82
.75	0	2	4.11	.75	11	1	10.23
2.00	1	0	0.72	7.00	12	1	5.78
.25	1	0	10.47	.25	13	1	2.49
.50	1	1	9.37	.50	14	1	0.33
.75	1	2	9.42	.75	15	0	11.33
3.00	2	0	10.61	8.00	16	0	11.47
.25	2	2	0.96	.25	17	1	0.77
.50	3	0	4.45	.50	18	1	3.20
.75	3	1	9.08	.75	19	1	6.79
4.00	4	0	2.87	9.00	20	1	11.52
.25	4	1	9.80	.25	21	2	5.40
.50	5	0	5.88	.50	23	0	0.43
.75	5	2	3.11	.75	24	0	8.60
5.00	6	1	1.48	10.00	25	1	5.93

APPENDIX B.

REPORT OF J. G. PARKE, NOVEMBER 12, 1859.[1]

United States Boundary Survey, Colville Depot,
Washington Territory, November 12, 1859.

Sir: I have the honor respectfully to submit the following report of the progress made during the past season in the survey of the forty-ninth parallel by the several parties of the United States commission:

The organization of the parties throughout the greater part of the season has been as follows: Two astronomical parties, one surveying party, one reconnoissance party.

Mr. G. Clinton Gardner, assistant astronomer and surveyor, in charge of an astronomical party; Professor Nooney, assistant.

Mr. Joseph S. Harris, in charge of second astronomical party; Mr. Hudson, assistant.

Mr. Charles T. Gardner, in charge of the surveying party.

Mr. H. Custer, in charge of the reconnoissance party.

Mr. J. Nevin King, in charge of Chiloweyuck depot, on Fraser rive and forwarding supplies to the parties in the field.

Dr. C. B. R. Kennerly, in charge of depot, Chiloweyuck lake, i addition to his duties as surgeon and naturalist.

Mr. George Gibbs, in addition to the geological reconnoissance, had charge of a party engaged in opening a trail through from the Skagit valley to the Similkameen.

Mr. R. V. Peabody, in charge of the subsistence and transportation for the parties to the eastward of the lake depot.

Mr. Major assisted in the computations at the astronomical stations.

The reconnoissance at the close of the last season extended as far east as the valley of the Skagit, and the astronomical observations necessary for marking the three points of the parallel in the valley of the Chiloweyuck were completed. On taking the field the present season, the first object was to complete the measurements and marking the parallel at these three stations, Tummeahai, Chiloweyuck lake, and Chuch-che-hum. Then make reconnoissance for the location of astronomical stations and the opening of trails in advance of the parties occupying these stations.

The first party, under the charge of Mr. G. C. Gardner, left Camp Simiahmoo for the Chiloweyuck depot on the eighteenth day of April.

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[1] Reprinted from Senate Ex. Doc. No. 16, 36th Cong., 1st sess., pp. 2-7.

The zenith telescope and transit instrument were put up and observations made for latitude and time. Reconnoitering and surveying parties took the field, with instructions to connect Sumass station with the depot and continue on over the trail, connecting the several astronomical stations, and to obtain the topography of the country along and adjacent to the boundary line. The pack mules were sent from their wintering station to the depot, and arrangements were made for the delivery of subsistence, stores, and forage, at that place.

A chronometer trip was made between Camp Simiahmoo and Chiloweyuck depot by a party under charge of Mr. Harris. Eleven chronometers were transported back and forth, and the entire trip being performed in whale-boats, it is confidently expected that a very nice determination of the difference of longitude will be obtained. The observations for time at the depot were made by Mr. Gardner, and those at Camp Simiahmoo by myself.

On the 19th of May, Mr. Harris left Camp Simiahmoo with the outfit for an astronomical and surveying party. On arriving at the depot, he started for the Tummeahai station, Mr. Custer having previously found a practicable route for a pack trail to that point on the left bank of the Chiloweyuck, it being impracticable at that time to cross the stream opposite the mouth of the Tummeahai. Mr. Custer commenced opening the trail; and, on Mr. Harris taking charge of the party, Mr. Custer continued his reconnoissance over to the Nooksahk, and up the tributaries of the Chiloweyuck.

The trail from the depot to Chiloweyuck lake was reopened and made practicable for pack mules, requiring bridging, corduroying, and heavy grading. The high water of the streams, and the great quantity of fallen timber, made the work very heavy, and required a strong force.

On the third of June I arrived at Chiloweyuck depot, and on the fourth, Mr. G. C. Gardner started for the lake depot. Arriving there, he put the boats in order, built a storehouse for the supplies, and commenced marking the parallel by cutting a vista through the timber across the valley, at the southern end of the lake. On the completion of this, he proceeded to Chuchchehum station, and made a cut there on the parallel, embracing the two crossings of the trail. The parallel at these stations was marked by pyramidal piles of stones from six to eight feet high, covering posts accurately marking points on the line. Mr. Harris marked the parallel in the same manner at the Tummeahai station, having cut a vista through the timber, embracing the two forks of the stream. On the completion of the work at Tummeahai, Mr. Harris proceeded to the lake depot, and commenced opening the trail through to the station on the Skagit river. Here again the work was very heavy, it requiring a force of from ten to eighteen men nearly one month to open about thirty-five miles of trail, of which nearly one-half had been traveled during the previous year. On reaching the valley of the Skagit Mr. Harris located his observatory, and commenced observations for determining the point where the parallel crosses the river.

While at Chiloweyuck depot, I found that our supply of pack mules was insufficient to enable the parties to progress with the work without great loss of time. Mules, apparejos, and pack-saddles were purchased, and additional packers employed, so that the supplies and outfits of the several parties were carried forward as rapidly as the work progressed and the trail was opened.

On Mr. Gardner's completing the work at Chuchchehum station, we proceeded to make a reconnoissance of the country to the east of Skagit station, with a view of locating astronomical stations and determining a route for a trail through to the Similkameen and Okinakane valleys, a region of country that had been heretofore unexplored and known only to a few Indian hunters. We found a mass of rugged and heavily timbered mountains, extending north and south, and having a breadth of about seventy-five miles. Through by far the greater portion of this distance, no trails were found; but, by dint of constant work of four axemen, we were enabled to force our way through the Similkameen. A good and practicable route was however found, crossing two summits having an elevation of about six thousand feet. A road party was immediately placed upon this route, under charge of of Mr. Gibbs. He was supplied with axes, picks, and shovels; and, after five weeks' labor with a strong force, a trail was opened, so that our instruments and supplies could be packed through without difficulty.

On returning from this reconnoissance Mr. Gardner started with his party to occupy a station on the Similkameen. And Mr. Harris, having completed his determination and marking of the parallel at the Skagit station, proceeded to occupy one nearly midway between the Skagit and Similkameen, on the Pasayten, a tributary of the latter. In the meantime, the survey connecting the astronomical stations was continued by the trail, the nearest practicable line to the parallel, as well as the reconnoissance of the country on both sides of the parallel. On the completion of the observations, computations, and marking the parallel at Pasayten, Mr. Harris's party moved on to the Similkameen, and remained there in camp, while Mr. Harris accompanied me on a reconnoissance, to select another station on the Nehoialpitkwu, about thirty-five miles to the eastward. After reaching the Similkameen, we had no difficulty in traveling, the country being open and grassy, and occupied by horseback Indians; numerous well-worn trails were found running in every direction. One of these we found particularly advantageous, leading eastward from the Similkameen to Fort Colville, on the Columbia river, a distance of about one hundred miles. After crossing the divide to the east of Lake Osogoos [sic], the trail strikes the Nehoialpitkwu, and follows down the valley of this stream crossing the parallel three times.

From the astronomical station on the Similkameen, two points of the parallel, at an interval of about fifteen miles, were determined and marked by triangulation: one at the crossing of the Similkameen and the other at Lake Osoyoos, in the valley of the Okinakane. The intervening country is generally destitute of timber, and made up of a collection of knobs and high hills with intervening plains and valleys, affording good ground for the location of well conditioned triangles.

The first station on the Nehoialpitkwu was occupied by Mr. Harris, and the parallel was determined by a measurement from the observatory, on the meridian, and marked by a cut, nearly a mile in length, across the valley, and by three monuments—two of earth and one of stone. At this station the stream passes from north to the south of the parallel.

The second station on the Nehoialpitkwu, about thirty miles distant by the trail, is now occupied by Mr. Gardner's party, and Mr. Harris's party is in position on the right bank of the Columbia river, near the mouth of Clarke's Fork. It is believed that these points of the parallel will soon be determined and marked, when these parties, together with the surveying and reconnoitering parties, are instructed to repair to this point and go into winter quarters. The weather, however, is at present very severe, the ground being covered with three or four inches of snow, and the thermometer giving readings for the last three mornings as low as four, two, and ten degrees below zero.

To recapitulate, the following is the amount of work accomplished by parties of the United States commission during the present season:

A completion of the determination and marking the parallel from three points astronomically fixed at the close of the last season.

A complete set of observations for latitude at four stations, from which the parallel has been determined and marked at the crossings of the following streams: the Skagit, Pasayten, Similkameen, Okinakane, (Lake Osoyoos,) and Nehoialpitkwu. And before the astronomical parties leave the field, the necessary observations will be completed for determining two other points of the parallel, the third crossing of the Nehoialpitkwu, and the Columbia river.

A chronometer trip for difference of longitude between Camp Simiahmoo and Chilowayuck depot.

Observations of the transit of the moon and moon-culminating stars at two of the latitude stations for absolute longitude.

A triangulation covering an area of about fifty square miles.

A survey of the nearest practicable lines to the parallel, connecting the astronomical stations, making a total distance chained of about three hundred and seventy miles.

Reconnoissances for developing the topography along and adjacent to the boundary line, and for locating routes of communication. These reconnoissances have extended over an area of about six thousand square miles.

A full set of magnetic observations were made at one station. And throughout the work, all the necessary observations for time, azimuth, micrometer value, and instrumental corrections were carefully made.

The two astronomical parties and the reconnoissance party were furnished with sets of meteorological instruments. Full and detailed registers have been kept at the different stations, and, as far as possible, simultaneous readings of the barometer have been taken, while the parties were moving from station to station; which, with the corresponding observations at camp Simiahmoo and the fixed stations, will enable us to give very exact profiles of the country traversed.

The geological reconnoissance has been extended over the field of operations, and valuable collections made of botanical and natural history specimens.

The forty-ninth parallel, as far as determined during the present season, traverses a mountainous country, and, excepting a few localities, the entire region is eminently unfit for occupation or settlement. The mountains are rugged and precipitous, and attain great elevations; the ridges and peaks of the Cascade mountains being covered with perpetual snow. Glaciers were discovered; and during the months of June and July snow to the depth of two feet was encountered on our very route of travel. A heavy growth of pines and fir abounds throughout the entire line from the Gulf of Georgia, with the exception of short intervals in the valleys of the Similkameen, Okinakane, and Nehoialpitkwu.

Under the forty-ninth parallel the Cascade mountains have a breadth of about two degrees in longitude, and as the general trend of these mountains is at right angles to the line of our work, we were necessarily forced into crossing the ridges with our routes of communication, involving much labor in cutting, grading, and bridging to make these routes practicable for even pack-mule transportation. The water courses are numerous and rapid, rendering the fords frequent and dangerous. A slight rise in these streams makes them impassable. Notwithstanding the difficulties of the country and the precarious mode of transporting the instruments, I am happy to report that we have got thus far through the season's work without any damage to our astronomical instruments. I regret, however, that we have been less fortunate with the magnetic instruments. The mule carrying these missed his footing and rolled down a precipitous bank. The magnetic theodolite will have to be replaced, and the other instruments will require repairing. I also have to report the breakage of our barometer. We were, however, able soon to replace this instrument from the lake depot.

On reaching the valleys of the Similkameen and Okinakane we were met by our additional escort, under the command of Captain Archer, United States army. I take great pleasure in acknowledging my obligations for the timely and valuable assistance rendered us by himself and officers of his command.

Preparations are now making at this place to winter the several parties on their return from the field. A great abundance of material for building quarters is found directly at hand. A supply of provisions has been procured.

The winters of this region are reported to be very severe on animals, the snow falling to a great depth. We have laid in a good stock of hay, and, by erecting temporary shelter, we have little fears of losing any of our mules.

Our work during the next season will extend from the Columbia river to the Rocky mountains. From careful inquiry, the entire distance is represented as mountainous and timbered, excepting perhaps a short stretch in the valley of the Kootenay, near the base of the Rocky mountains. In this valley the Hudson's Bay Company have a trading post near to the parallel. This post is supplied from Fort Colville, and the company's trail to that point will no doubt be of great service to us in sending parties to the line, particularly to those stations close to the Rocky mountains.

In reference to the mode or order of proceeding with the astronomical stations during the next season, I would respectfully suggest that we be allowed to proceed directly to the extreme eastern stations, so that on the melting of the snows, we will be able to complete those, and retire in good season, leaving these nearer this depot for the last. By following this plan we will have less difficulty in falling back on this place, in the event of any great detention or delay from ruggedness of country and swollen streams, or even should the winter set in before the completion of the work. It is confidently expected, however, that we will be able to complete all of the astronomical stations during the next season. Mr. Gibbs is at present making a reconnoissance of the trail in the direction of the Kootenay. This will enable us to commence in the early spring with a working party on this route. It is believed that we will have to build bridges and make flatboats for ferrying Clarke's Fork (Pend d'Oreille) and one of its tributaries, besides much cutting and corduroying.

Before closing this report I take great pleasure in again commending to you the great zeal and devotion to duty evinced by the assistant astronomer and surveyor, and the several assistants engaged upon the work; and I am happy to say that the amount of work accomplished during the season has quite equalled the highest estimates.

I have the honor to be, very respectfully, your obedient servant,

JOHN G. PARKE,
Lieut. Corps Top. Eng's, Chief Astron'r and Surv'r.

APPENDIX C.

REPORT OF ARCHIBALD CAMPBELL, FEBRUARY 3, 1869.[1]

UNITED STATES NORTHWESTERN BOUNDARY COMMISSION.
Washington, D. C., February 3, 1869.

SIR: I have the honor to acknowledge the receipt of your letter of the 16th ultimo, asking for information concerning the matters mentioned in a resolution of the House of Representatives of the 13th of January:

> That the Secretary of State be directed to communicate to the House the total amount expended for the northwestern boundary commission, and to give in detail the items of expenditure, the number and names of persons employed in such commission, how long employed, and at what salaries, and the nature and extent of the services performed.

In reply to your letter I have the honor to transmit herewith the following papers:

Financial statement, January 1, 1869, marked A.

List of persons composing the commission, with rates of salaries &c., marked B.

List of assistants employed in running and marking the boundary line, with statement of pay, &c., marked C.

List of assistants employed in working up the results of the survey, with statement of pay, &c., marked D.

Statement of labor employed in running and marking the boundary line, marked E.

Statement of services of Indians, marked F.

In regard to "the nature and extent of the services performed," nothing short of the full reports of the chief astronomer and surveyor, and other officers of the commission, and the detailed maps of the survey of the boundary line, can give an adequate idea of the subject. It is not supposed, however, that the House of Representatives desires so comprehensive a reply to their inquiry. I shall therefore endeavor as briefly as possible to furnish the information called for.

On the 11th August, 1856, Congress passed a law, authorizing the appointment of a commission on the part of the United States, to unite with a similar commission to be appointed by Great Britain, for the purpose of carrying into effect the first article of the treaty of June 15,

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[1] Reprinted from House Ex. Doc. 86, 40th Congress, 3d session.

1846, that is, to determine and mark the boundary line between the United States and British possessions, agreed upon in the treaty, viz:

> From the point on the 49th parallel of north latitude, where the boundary laid down in existing treaties and conventions between the United States and Great Britain terminates, * * * westward along the said 49th parallel of north latitude, to the middle of the channel which separates the continent from Vancouver's island, and thence southerly, through the middle of the said channel and of Fuca's straits, to the Pacific ocean.

Toward the close of the year the British Government appointed Captain Prevost, royal navy, commanding steamer Satellite, first commissioner to determine that part of the line which runs through "the channel which separates the continent from Vancouver's island," and announced that he had started on his way to the vicinity of the boundary line, and that Captain Richards, royal navy, second commissioner, would shortly follow.

Although the powers of the British commission were limited to the determination of the water-boundary alone, while the act of Congress authorized, on the part of the United States, the determination of the boundary from the crest of the Rocky mountains to the Pacific ocean, the President decided to carry out the law by the appointment of officers authorized thereby, and to notify the British government of the difference between the powers of the two commissions. In February, 1857, I was appointed commissioner, Lieutenant John G. Parke, United States army, chief astronomer and surveyor, and G. Clinton Gardner, assistant astronomer and surveyor, on the part of the United States.

Under instructions from the State Department, the United States commission was duly organized and directed to repair to Fuca's straits, via San Francisco, to meet the British commission. At the close of June, I met Captain Prevost, the British commissioner, at Esquimalt harbor, at the southern end of Vancouver's island, and was informed by him that until the arrival of Captain Richards, second commissioner, with the surveying party, he was not prepared to enter upon the determination of the water boundary. The United States commissioner therefore proceeded to the western terminus of the 49th parallel, on the main land, and established a depot and located an observatory, for the commencement of the survey along the 49th parallel, eastward, to the crest of the Rocky mountains. The British government not yet having provided a commissioner for that part of the boundary line, we were obliged to commence the work without its co-operation. Reconnoissances and explorations in the vicinity of the boundary line were at once commenced, and continued as long as the season permitted field operations. Before the spring, four astronomical points on the 49th parallel were determined, and the country thoroughly reconnoitered in the vicinity of the parallel, for a considerable distance eastward.

Towards the close of October, Captain Prevost visited the 49th parallel and informed me that Captain Richards had not yet arrived, but that, as he had satisfied himself of the general accuracy of the United States Coast Survey chart of the channels and islands between the continent and Vancouver's island, he should act independently of him. He therefore proposed that we should at once proceed to the determination of the water boundary. Several meetings of the joint commission accordingly took place, at which the question of the boundary channel was verbally discussed. The British commissioner claimed Rosario straits (the channel nearest the continent,) while I claimed the Canal de Haro, (the channel nearest Vancouver's island) as the boundary channel, intended by the treaty. Between these two channels lies the Haro archipelago, a group of islands, of which San Juan forms a part.

The verbal discussion was followed by a correspondence on the subject, in which the merits of the question were fully set forth. Captain Prevost concluded the correspondence by a proposition to compromise the difference, by running the boundary through an intermediate channel which would secure the island of San Juan to Great Britain. This proposition I declined.

For more full information in regard to the question of the water boundary I would respectfully refer to Senate Ex. Doc. No. 29, 2d session, 40th Congress. This document contains the correspondence above referred to, with a geographical memoir of the islands in dispute, and a map and cross-sections of the channels.

In conformity with the fifth section of the act organizing the commission, the President (through the Secretary of the Treasury) directed the Superintendent of the Coast Survey to place the steamer Active and brig Fauntleroy at the disposal of the commissioner when required. Both vessels were accordingly employed for the survey and soundings of the various channels and islands between the continent and Vancouver's island, a portion of the expenses of the Active being paid by the commission during the time that vessel was employed on this duty.

After the arrival of the British surveying steamer Plumper, Captain Richards co-operated with the United States Coast Survey vessels, and a thorough and complete survey of all the channels and islands between the continent and Vancouver's island south of the 49th parallel was made.

The map above referred to is the result of this joint survey, which occupied several seasons.

In the summer of 1858 Col. J. S. Hawkins, royal engineers, appointed by the British government commissioner to determine the boundary line along the 49th parallel, arrived from England with a suitable party organized for field operations. At the time of his arrival the excitement arising from the discovery of gold on Frazer river was at its height. This event caused for a time great increase in the price of labor and supplies, and created considerable embarrassment, delay, and additional expense in the field operations of the season.

A meeting of the joint commission was held for the purpose of agreeing upon a plan of field operations for the survey of the land boundary. The following is a copy of the arrangement made:

> After discussing plans for determining and marking the line as far eastward as the Cascade mountains, it was concluded to be inexpedient at the present time, in consequence of the great expense, consumption of time, and the impracticable nature of the country, to mark the whole boundary by cutting a track through the dense forest.
>
> It was therefore agreed to ascertain points on the line by the determination of astronomical points at convenient intervals on or near the boundary, and to mark such astronomical stations, or points fixed on the parallel forming the boundary, by cutting a track of not less than 20 feet in width on each side for the distance of half a mile or more, according to circumstances. Further, that the boundary be determined and similarly marked where it crosses streams of any size, permanent trails, or any striking natural feature of the country.
>
> In the vicinity of settlements on or near the line, it is deemed advisable to cut the track for a greater distance, and to mark it in a manner to be determined hereafter.

The work of running and marking the land boundary was carried on through a country previously almost unknown. The 49th parallel extends over rugged and precipitous mountains that attain great elevation, and in the Cascade range, on and near the boundary, perpetual snow covers many of the peaks, whose northern gorges are filled up with immense glaciers. The timber on the western slope of the Cascade mountains is dense, being a heavy growth of pine and fir, that in many places stands over a fallen forest not yet decayed. This is the character of the country as far east as the valley of the Similkameen river, one of the tributaries of the Columbia. Here the timber becomes more open and surveying operations less difficult.

After passing the Okinokane river, which is the lowest line of the great valley between the Cascade and the Rocky mountains, the country again becomes rough and the timber more dense, but less so than the western slope of the Cascade mountains.

It being impossible to follow the 49th parallel continuously, the line of survey was carried over the nearest practicable route for a pack trail, connecting each astronomical station, making a total length of line of survey of about 800 miles. Astronomical stations were established by parties of the joint commission at almost every accessible point from which the boundary line is ascertained, and marked by a vista across all valleys and trails, where rough stone monuments were erected over posts buried in the ground to indicate the exact line.

The reconnaissance work extends over an area of about 30,000 square miles. Within this space the barometrical heights of over 800 points have been obtained.

A magnetic survey, extending over a range of 3° 20′ in latitude and 4° in longitude, with the necessary observations of the magnetic elements of the astronomical stations, was also made.

The entire length of the land boundary line is over 9° in longitude, or about 410 miles, and the length of the route traveled in surveying it is double that distance. Trails had to be opened for three-fourths of the distance traveled, involving great labor in cutting, grading, and bridging to make the route practicable for pack-mule transportation. The water-courses were numerous and rapid, rendering the fords frequent and dangerous; and a slight rise of many of the streams would have made them impassable but for the timely precaution of building bridges at small streams and ferry boats at the river crossings. Many of the trails opened are now traveled routes to the mines then and since discovered, which are rapidly developing that section of the country, where almost every valley of any extent affords facilities for agricultural pursuits.

In collating the results of the survey reports upon the geology, botany, and natural history of the country reconnoitered were prepared, and complete maps, on a large scale, made of the entire boundary and the adjacent country. A general map has also been made, showing the extent of the country traversed. And to facilitate the survey of the public lands, photographic duplicates of the detailed sheets, showing each monument on the boundary line, with its geographical position, were furnished to the General Land Office. Photographic duplicates of the detailed sheets of the water boundary have also been made and furnished the Department of State in illustration of the question of the boundary channel.

I have the honor to be, very respectfully, your obedient servant,

ARCHIBALD CAMPBELL,
Commissioner Northwest Boundary Survey.

Hon. WILLIAM H. SEWARD,
Secretary of State.

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DEPARTMENT OF THE INTERIOR

BULLETIN

OF THE

UNITED STATES

GEOLOGICAL SURVEY

No. 175

WASHINGTON
GOVERNMENT PRINTING OFFICE
1900

UNITED STATES GEOLOGICAL SURVEY

CHARLES D. WALCOTT, DIRECTOR

TRIANGULATION AND SPIRIT LEVELING

IN

INDIAN TERRITORY

BY

C. H. FITCH

WASHINGTON
GOVERNMENT PRINTING OFFICE
1900

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LETTER OF TRANSMITTAL.

DEPARTMENT OF THE INTERIOR,
UNITED STATES GEOLOGICAL SURVEY,
Washington, D. C., June 6, 1900.

SIR: I have the honor to transmit herewith, for publication as a bulletin, the results of the primary triangulation and the leveling executed in Indian Territory from 1895 to 1898, inclusive.

Very respectfully,

C. H. FITCH, *Topographer.*

Hon. CHARLES D. WALCOTT,
Director United States Geological Survey.

TRIANGULATION AND SPIRIT LEVELING IN INDIAN TERRITORY.

By C. H. Fitch.

INTRODUCTION.

An act of Congress, approved March 2, 1895, appropriated $200,000 for the survey and subdivision of lands in Indian Territory, and the work was placed, at the discretion of the Secretary of the Interior, in charge of the Director of the Geological Survey.

A plan of operations was approved by the Secretary of the Interior March 21, 1895, Mr. C. H. Fitch was placed in immediate charge of the field work, and preparations were at once made for beginning operations. The requisite instruments, animals, and equipment were soon purchased and a small force took the field about the 1st of April. The force was increased as rapidly as consistent with economic management until about 300 men were engaged in the work of surveying standard, township, and subdivision lines.

The approved plan included the preparation of a topographic map of the area surveyed, which necessitated the execution of a system of triangulation and the running of spirit-level lines, thus affording horizontal and vertical control for the topographic map as well as the linear measurements.

The first parties organized were for the establishment of standard and township exterior lines. Subdivision parties were next organized, each party being divided into two camps with two surveyors in each camp, under the direction of a topographer of the survey whose duties included superintendence of the work of subdivision by the surveyors and the mapping the country subdivided.

An additional appropriation of $200,000 was provided by Congress June 10, 1896, also of $100,000 June 6, 1897, and $30,000 January 28, 1898. The latter amount would probably not have been necessary had the survey progressed without interruption, but the disbanding of the field parties in the spring of 1897, caused by the delay in the provision of funds and the long moves of the parties in the reorganization, added considerably to the expense. A resurvey of the lands of the Chickasaw Nation was provided for in the act approved June 6, 1897, which appropriated $141,500 for this purpose.

The total amount appropriated for surveys in Indian Territory. which included the lands of the Cherokees, Creeks, Choctaws, and Seminoles, was $530,000, which added to the amount provided for the resurvey of the Chickasaw lands amounts to $671,500.

The total number of miles of standard, township, and subdivision lines surveyed, from the inception of the work to its completion in June, 1898, was 63,881. The topographic mapping completed at the same time covered an area of 30,885 square miles; in connection with which 133 triangulation stations were established, 9,303 miles of spirit level and 8,594 miles of vertical angles were run, and 920 permanent bench marks were located.

TRIANGULATION.

The base for the triangulation was measured in April, 1895, on the railroad tangent which passes through Savanna, a station on the Missouri, Kansas and Texas Railway, the northern end of the base being about three-fourths of a mile north from Savanna station and 7 miles south from South McAlester. This base was measured twice with a 300-foot steel tape under a tension of 20 pounds, and the temperature of tape determined at each tape length by reading three thermometers. The difference of the two measures (when corrected for difference in temperature) was 0.03 feet.

The resulting length of base, when corrected for temperature, inclination, and reduced to sea level, is 24,893.451 feet, log. meters= 3.8800962.

Stations in the expansion were selected on the wooded ridges to the eastward and signals from 25 to 40 feet high erected. The lines between these stations formed bases for the main triangulation, which in 1895 was extended 45 miles southward and 110 miles northward from the base. The triangulation south of Savanna was executed by Mr. S. S. Gannett in May and June, 1895, the triangulation north of Savanna to the Kansas line by Mr. C. F. Urquhart during 1895, 1896, and 1897.

Mr. Urquhart also extended triangulation over the Chickasaw Nation between February and June, 1898. Mr. H. L. Baldwin, jr., controlled the eastern portion of the Choctaw Nation in 1897. Triangulation was extended into Grayson County, Texas, by Mr. Jeremiah Ahern during the latter part of the season of 1898.

The total number of stations occupied by the various observers was 133, the greater number being occupied by Mr. Urquhart.

The instruments used were Fauth theodolites, each having a circle 8 inches in diameter and reading by micrometer microscopes to 2″ of arc.

In most cases the theodolite was elevated from 25 to 60 feet, in order

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to see above the timber. An interior tripod, made of 2 by 4 inch scantling, well braced, was first erected; outside of this, and entirely independent of it, a four-sided platform was built for the observer to stand on and also to support the signal, which was above center of tripod.

The total area controlled is about 31,000 square miles.

The geodetic coordinates of all stations were first computed from Savanna astronomic station, using the observed azimuth taken at north base.

Check azimuth observations were made at stations Barber, Harman, Purcell, and Good.

After connections with other astronomic positions had been made, as mentioned below, a mean value dependent upon all four was adopted and a constant correction of +1.08″ in latitude and +10.72″ in longitude was applied to all positions previously computed.

In 1896–97 connection was made with Poteau, Cavanal, Peak, and Sugarloaf, stations of the Arkansas triangulation of 1887, whose positions depend upon a mean value adopted from Fort Smith and Little Rock astronomic stations of the United States Coast and Geodetic Survey.

In 1899, Marlow, the extreme western triangulation station in the Chickasaw Nation, was connected by primary traverse with the astronomic station of the United States Coast and Geodetic Survey at Marlow railroad station.

In December, 1899, Wasson triangulation station, in the northern portion of the Cherokee Nation, was connected by primary traverse with the astronomic station located in 1884 by Prof. R. S. Woodward, United States Geological Survey, at Oswego, Kansas.

Comparisons of positions computed from Savanna with other astronomic locations:

	Latitude difference.	Longitude difference.
	Feet.	*Feet.*
Savanna	+ 0	+ 0
Marlow	+ 201	1,143
Fort Smith and Little Rock	− 267	1,149
Oswego	+ 503	821
	+ 109	+ 778
		+ [1]117
Total		+ 895
Correction	+1.08	+10.72

---

[1] Longitude increase by Coast and Geodetic Survey adjustment published 1897.

Incidentally to the connection between Wasson triangulation station and Oswego the latitude of the Kansas-Indian Territory boundary line was determined by Mr. E. M. Douglas, in December, 1899, from Oswego, the value 37° 00′ 04.18″ being 422 feet north of the parallel of 37°.

DESCRIPTIONS AND POSITIONS OF STATIONS.

SAVANNA, CHOCTAW NATION (Astronomic station).

Situated on high ground about 300 yards northeast of railroad station at Savanna. The pier is made of brick laid in cement, with its base on solid rock.

Observations for latitude and longitude were made with the Fauth combined transit and zenith telescope, No. 534.

The latitude was determined by Talcott's method, and the Washington Observatory at St. Louis was used as the initial or base station for the longitude determination. The observer at St. Louis was Mr. A. Ramel and at Savanna Mr. S. S. Gannett, the relative personal equation of the observers being determined on two nights in April, 1895, preceding the longitude observations proper, the result showing that Ramel observed later than Gannett 0.075″±0.024″.

The difference of longitude was determined on five nights, the mean being 22′ 32.179″±0.017″.

The resulting longitude west of Greenwich is in arc

95° 50′ 21.33″ observed.
+10.72

95 50 32.05 geodetic mean.

The mean of 37 results for latitude is

34° 48′ 46.49″±0.18″ observed.
+ 1.08

34 49 47.57 geodetic mean.

North base station was occupied upon one night as an azimuth station, the mark being placed at South base.

SAVANNA NORTH BASE, CHOCTAW NATION.

About three-fourths mile northeast of Savanna railroad station, 60 feet west from and at right angles to west rail of Missouri, Kansas and Texas Railway track, in open country. Theodolite elevated 24 feet.

Station mark: A stone post 36 by 6 by 6 inches, set 30 inches in the ground. Center of station marked by cross cut in the rock.

Reference stones are set to the east, west, and north. Distances from center of station to nearest corners of stones, E. 9.87 feet, W. 10.06 feet, N. 9.64 feet, respectively.

[Latitude, 34° 50′ 22.84″. Longitude, 95° 50′ 12.18″.]

To station.	Azimuth.	Back azimuth.	Log. distance.
	° ′ ″	° ′ ″	*Meters.*
South base	33 43 24.62	213 41 50.02	3.8800962
Johnstown	50 31 31.40	230 30 23.28	3.5940794
Lost	239 54 57.65	59 57 1.39	3.8031660
Hickory	350 44 14.27	170 44 43.88	3.9136236

SAVANNA SOUTH BASE, CHOCTAW NATION.

On a flat summit 4 miles south-southwest of Savanna station; out 3,000 feet south from end of tangent and on line with its pro-igation. Theodolite elevated 24 feet.

Station mark: A stone post, 36 by 6 by 6 inches, set 30 inches in the ound. Center of station marked by x cut in the rock.

Reference stones are set to the east, west, and south. Distances om center of station to nearest corners of stones, E. 9.69 feet, W. .01 feet, S. 9.49 feet.

[Latitude, 34° 46′ 58.02″. Longitude, 95° 52′ 57.86″.]

To station—	Azimuth.	Back azimuth.	Log. distance.
	° ′ ″	° ′ ″	*Meters.*
Pine	10 44 37.45	190 43 26.55	4.2306990
Johnstown	197 10 45.03	17 11 11.51	3.6012690
Lost	225 36 58.22	45 40 36.52	4.1330090
Hickory	287 47 59.87	107 49 63.96	3.7642305

JOHNSTOWN, CHOCTAW NATION.

On the wooded ridge about 1½ miles southwest of Savanna. The-olite elevated 30 feet on the trunk of a tree.

Station mark: A pile of rocks around foot of tall tree trunk, which rmed support for instrument. Adjacent trees have side facing cen-r of station, blazed.

[Latitude, 34° 49′ 01.81″. Longitude, 95° 52′ 11.46″.

To station—	Azimuth.	Back azimuth.	Log. distance.
	° ′ ″	° ′ ″	*Meters.*
Pine	11 58 23.55	191 56 46.25	4.3218489
South base	17 11 11.51	197 10 45.03	3.6012690
Dalton	77 20 17.06	257 11 45.82	4.3683730
Whaleback	108 59 36.48	288 56 06.78	3.9941268
North base	230 30 23.28	50 31 31.40	3.5940794
Lost	236 18 46.96	56 21 58.86	4.0107371
Hickory	322 06 06.26	142 07 43.97	3.8503912

HICKORY, CHOCTAW NATION.

About 4 miles (air line) southeast of Savanna; on a prom wooded butte. From north boundary of T. 3 N., R. 14 E., at p 30.82 chains east on line between secs. 3 and 34, station bears W., 6.04 chains distant. Theodolite elevated 30 feet.

Station mark: A rock marked $\overset{\text{U. S.}}{\underset{\text{G. S.}}{+}}$

[Latitude, 34° 46′ 00.32″. Longitude, 95° 49′ 20.30″.]

To station—	Azimuth.	Back azimuth.	Log. distance
	° ′ ″	° ′ ″	*Meters.*
Pine	30 15 56.50	210 12 41.79	4.2377005
Dalton	91 01 25.80	270 51 17.21	4.4336580
South base	107 50 03.96	287 47 59.87	3.7642305
Whaleback	122 47 02.83	302 41 55.55	4.2113390
Johnstown	142 07 43.97	322 06 06.26	3.8503912
North base	170 44 43.88	350 44 14.27	3.9136236
Lost	200 20 59.84	20 22 33.85	4.0801000

LOST, CHOCTAW NATION.

On a flat, heavily timbered ridge, about 2 miles east of the Missou Kansas and Texas Railway and 4 miles south of South McAlest A wagon road was cut through the woods, approaching from t gap in the ridge 1 mile south of summit. Theodolite elevated 40 fe

Station mark: A stone post, 36 by 6 by 6 inches, set 30 inches in t ground, marked thus: U. △ S.

[Latitude, 34° 52′ 06.18″. Longitude, 95° 46′ 35.65″.]

To station—	Azimuth.	Back azimuth.	Log. distance.
	° ′ ″	° ′ ″	*Meters.*
Hickory	20 22 33.85	200 20 59.84	4.0801000
Pine	26 13 33.39	206 08 44.55	4.4654650
South base	45 40 36.52	225 36 58.22	4.1330090
Johnstown	56 21 58.86	236 18 46.96	4.0107371
North base	59 57 01.39	239 54 57.65	3.8031660
Dalton	71 01 02.83	250 49 19.44	4.5201800
Whaleback	82 09 51.07	262 03 09.28	4.2559538
Scipio	152 39 24.59	332 33 47.99	4.5098914
Gaines	215 48 19.74	35 55 03.63	4.4843524
Hewitt	350 55 01.87	170 56 43.85	4.4605759

WHALEBACK, CHOCTAW NATION.

On a long, flat ridge, 8 miles west-northwest of Savanna, about 13 les southwest of South McAlester. Summit is clear of timber at rthern end, but is heavily timbered at southern end. Theodolite vated 20 feet.

Station mark: A stone post, 26 by 7 by 7 inches, sunk 24 inches in ground; marked U. △ S.

[Latitude, 34° 50′ 45.85″. Longitude, 95° 58′ 18.64″.]

To station—	Azimuth.	Back azimuth.	Log. distance.
	° ′ ″	° ′ ″	*Meters.*
Dalton	58 11 07.56	238 06 05.66	4.1994140
Shawnee	123 22 21.34	303 17 09.95	4.2187031
Scipio	183 22 55.57	5 24 02.14	4.4960782
Lost	262 03 09.28	82 09 51.07	4.2559538
Johnstown	288 56 06.78	108 59 36.48	3.9941268
Hickory	302 41 55.55	122 47 02.83	4.2113390
Hewitt	319 10 56.92	139 19 19.36	4.5362443
Pine	348 06 10.04	168 08 01.89	4.3847552

PINE, CHOCTAW NATION.

On the highest part of a long pine-timbered ridge, about 5 miles uth of Kiowa. It can best be reached by taking the road from Kiowa King's sawmill, and where it crosses top of mountain turn south, llowing the crest about 1½ miles through the woods to the station. heodolite elevated 50 feet.

Station mark: A hole drilled in the solid rock; marked U. S. G. S.

[Latitude, 34° 37′ 55.69″. Longitude, 95° 55′ 02.35″.]

To station—	Azimuth.	Back azimuth.	Log. distance.
	° ′ ″	° ′ ″	*Meters.*
Bald	32 45 12.42	212 39 21.00	4.4664448
Indian	52 27 18.16	232 20 14.18	4.3810514
Giant	59 14 40.63	239 02 07.68	4.5960108
Sulser	101 39 21.12	281 24 04.68	4.6218176
Ninas	113 01 14.45	292 50 32.85	4.4935900
Dalton	129 51 37.94	309 44 45.08	4.3806474
Whaleback	168 08 01.89	348 06 10.04	4.3847552
South base	190 43 26.55	10 44 37.45	4.2306990
Johnstown	191 56 46.25	11 58 23.55	4.3218489
Lost	206 08 44.55	26 13 33.39	4.4654650
Hickory	210 12 41.74	30 15 56.50	4.2377005

DALTON, CHOCTAW NATION.

On the highest part of a timbered ridge, about 1 mile north of McAlester's pasture and 1½ miles northeast of a settlement known as Caney Valley. The corner common to secs. 34, 35, 3, and 2, Ts. 3 and 4 N., R. 11 E., may be reached from the station by going due south 18.44 chains, thence S. 82° 30′, W. 32.67 chains. (To change bearings to magnetic declinations add 8° 47′ to each.) Theodolite elevated 30 feet.

Station mark: Rock marked U. S. G. S.

[Latitude, 34° 46′ 14.77″. Longitude, 96° 07′ 07.55″.]

To station—	Azimuth.	Back azimuth.	Log. distance.
	° ′ ″	° ′ ″	*Meters.*
Indian	1 04 35.71	181 04 23.13	4.4779536
Ninas	72 27 51.21	252 24 01.93	4.0305634
Shawnee	178 42 21.97	358 42 13.02	4.2417862
Whaleback	238 06 05.66	58 11 07.56	4.1994140
Lost	250 49 19.44	71 01 02.83	4.5201800
Johnstown	257 11 45.82	77 20 17.06	4.3683730
Hickory	270 51 17.21	91 01 25.80	4.4336560
Pine	309 44 45.08	129 51 37.94	4.3806474

HEWITT, CHOCTAW NATION.

On a prominent mountain locally known as Bald Mountain, 22 miles by road southwest of Hartshorne and the same distance northeast of Stringtown; 17 miles southeast of Kiowa, at the northeast end of McGee's prairie. The summit is well covered with black jack and pine. The station is situated on highest part, and timber west and northwest of it was cut down.

Station mark: Blazed pine tree.

[Latitude, 34° 36′ 40.72″. Longitude, 95° 43′ 36.72″.]

To station—	Azimuth.	Back azimuth.	Log. distance.
	° ′ ″	° ′ ″	*Meters.*
Pine	97 35 11.74	277 28 42.20	4.2459604
Whaleback	139 19 19.36	319 10 56.92	4.5362443
Hickory	153 08 03.82	333 04 48.28	4.2863359
Lost	170 56 43.85	350 55 01.87	4.4605759
Hartshorne	215 09 04.93	35 14 24.67	4.3944219
Dexter	271 58 10.85	92 08 49.08	4.4571430
Kosoma	336 43 52.60	156 47 34.00	4.4025800

NINAS, CHOCTAW NATION.

On a timbered ridge, about 2 miles north of South McAlester-Stonewall road, at a point 25 miles from South McAlester, about 3 miles northwest from Mr. Ninas's house. The station may be reached from the corner common to secs. 10, 11, 14, and 15, T. 3 N., R. 10 E., by going N. 0° 2′ W. 20 chains, thence S. 76° 15′ E. 3.57 chains. Theodolite elevated 40 feet.

U. S.
Station mark: A rock marked +
G. S.

[Latitude, 34° 44′ 29.70.″ Longitude, 96° 13′ 49.72.″]

To station—	Azimuth.	Back azimuth.	Log. distance.
	° ′ ″	° ′ ″	*Meters.*
Sulser	72 59 14.49	252 54 38.97	4.1096480
Gully (approximate)	131 19 27.50	311 15 29.50	4.14981
Hawkins	142 58 06.97	322 51 47.81	4.4466067
Shawnee	205 22 34.79	25 26 16.86	4.3598037
Dalton	252 24 01.93	72 27 51.21	4.0305633
Pine	292 50 32.85	113 01 14.45	4.4935900
Indian	340 07 02.27	160 10 38.18	4.4549690

SULSER, CHOCTAW NATION.

On a high timbered ridge, about 2 miles west from Coalgate-Allen road, at a point 16 miles from Coalgate. Station may be reached from the quarter corner on line between secs. 28 and 29, T. 3 N., R. 9 E., by going N. 74° 20′ E. 12 chains, thence N. 28° 30′ E. 15.18 chains, thence N. 37° E. 17.34 chains. Theodolite elevated 35 feet.

U. S.
Station mark: A rock marked +
G. S.

[Latitude, 34° 42′ 27.22.″ Longitude, 96° 21′ 53.40″.]

To station—	Azimuth.	Back azimuth.	Log. distance.
	° ′ ″	° ′ ″	*Meters.*
Gully (approximate)	187 20 58.00	7 21 36.00	4.12057
Ninas	252 54 38.97	72 59 14.49	4.1096480
Pine	281 24 04.68	101 39 21.12	4.6218176
Indian	316 14 38.75	136 22 49.24	4.5032656
Giant	345 49 05.84	165 51 46.50	4.4697694

INDIAN, CHOCTAW NATION.

On the highest oak-timbered hill, about 4 miles northwest of Stringtown, 8 miles north of Atoka, 8 miles northeast of Lehigh, and 3 miles northwest of Sullivan's sawmill. Station may be reached from the closing corner between secs. 2 and 3, T. 1 S., R. 11 E., by going S. 2° E. 20 chains, thence S. 79° 15′ E. 7 chains, thence S. 18° 15′ E. 9 chains, thence S. 3° 15′ E. 5.19 chains. Theodolite elevated 35 feet.

Station mark: An irregularly shaped sand rock set flush with surface of ground and marked $\overset{\text{U. S.}}{\underset{\text{G. S.}}{+}}$ Above this is a pile of rocks 3 feet high.

[Latitude, 34° 29′ 59.51″. Longitude, 96° 07′ 29.68″.]

To station—	Azimuth.	Back azimuth.	Log. distance.
	° ′ ″	° ′ ″	Meters.
Giant	69 28 29.56	249 23 00.90	4.1993788
Sulser	136 22 49.24	316 14 38.75	4.5032656
Ninas	160 10 38.18	340 07 02.27	4.4549690
Dalton	181 04 23.13	1 04 35.71	4.4779536
Pine	232 20 14.18	52 27 18.16	4.3810514
Bald	341 55 30.88	161 56 42.87	4.0201200

GIANT, CHOCTAW NATION.

On the highest part of a large, flat, timbered ridge, 3 miles west-southwest of Lehigh. All timber has been cut down, permitting an extensive view in all directions excepting north-northeast. From the corner common to secs. 19, 20, 29, and 30, T. 1 S., R. 10 E., the station may be reached by going N. 8° 47′ E. 7 chains, thence N. 74° 47′ W. 15.59 chains.

Station mark: A post-oak tree, trimmed and standing alone.

[Latitude, 34° 26′ 59.04″. Longitude, 96° 17′ 10.31″.]

To station—	Azimuth.	Back azimuth.	Log. distance.
	° ′ ″	° ′ ″	Meters.
Buffalo	16 34 46.23	196 32 02.36	4.4159775
Sulser	165 51 46.50	345 49 05.84	4.4697694
Pine	239 02 07.68	59 14 40.63	4.4960108
Indian	249 23 00.90	69 28 29.56	4.1993788
Bald	283 37 04.00	103 43 44.23	4.2695412
Forest	306 23 54.12	126 32 10.36	4.4459746
Sugarloaf (2)	327 44 31.13	147 53 10.47	4.6461276
Caddo	357 09 43.02	177 10 26.98	4.6067000

BALD, CHOCTAW NATION.

On a bald hill 3 miles north of Atoka, about 300 feet above and three-fourths mile east of the Missouri, Kansas and Texas Railway. From the quarter corner on line between secs. 1 and 6, T. 2 S., Rs. 11 and 12 E., station may be reached by going due north 4 chains, thence N. 6° 15′ E. 12.28 chains.

Station mark: A flinty sandstone post, 26 by 6 by 8 inches, set 24 inches in ground. Top of rock is marked U. △ S.

[Latitude, 34° 24′ 36.34″. Longitude, 96° 05′ 22.43″.]

To station—	Azimuth.	Back azimuth.	Log. distance.
	° ′ ″	° ′ ″	*Meters.*
Caddo	24 10 28.68	204 04 34.255	4.5957933
Giant	103 43 44.23	283 37 04.00	4.2695412
Indian	161 56 42.87	341 55 30.88	4.0201200
Pine	212 39 21.00	32 45 12.42	4.4664448
Forest	340 16 23.71	160 18 00.24	4.1125840
Sugarloaf (2)	350 34 44.75	170 36 45.32	4.5253280

FOREST, CHOCTAW NATION.

On the highest land about 10 miles southeast of Atoka in an unbroken forest, one-half mile southwest of cabin occupied by Jim Seever. From the corner common to secs. 9, 10, 15, and 16, T. 3 S., R. 12 E., station bears S. 40° 15′ W., 15.74 chains distant. Theodo ite elevated 60 feet.

Station mark: A rock, 39 by 6 by 8 inches, set 36 inches in the round, marked U. △ S.

[Latitude, 34° 18′ 00.41″. Longitude, 96° 02′ 31.39″.]

To station—	Azimuth.	Back azimuth.	Log. distance.
	° ′ ″	° ′ ″	*Meters.*
Sugarloaf (2)	356 58 28.94	176 58 53.14	4.3201576
Caddo	40 49 46.98	220 42 16.94	4.4969643
Giant	125 32 10.36	306 23 54.12	4.4459746
Bald	160 18 00.24	340 16 23.71	4.1125840

BUFFALO, CHOCTAW NATION.

On high ground locally known as Buffalo Head, 10 miles west-northwest of Caddo, one-fourth mile west of the Caddo-Wapanucka road, one-eighth mile north of house occupied by Forbes Leflore. The summit is steep on north side, but slopes gently toward the south. From quarter corner on line between secs. 8 and 9, T. 4 S., R. 9 E., station bears N. 67° 07′ E., 25.20 chains distant. Theodolite elevated 30 feet.

Station mark: A sandstone post, 20 by 8 by 8 inches, set 15 inches in very hard, rocky ground.

[Latitude, 34° 13′ 28.36″. Longitude, 96° 22′ 00.84″.]

To station—	Azimuth.	Back azimuth.	Log. distance.
	° ′ ″	° ′ ″	*Meters.*
Standard section corner	13 28 19.33	193 26 58.11	4.2019780
Giant	196 32 02.36	16 34 46.23	4.4159775
Sugarloaf (2)	291 48 46.96	112 00 07.96	4.5246785
Caddo	328 27 28.73	148 30 55.68	4.2568325

STANDARD SECTION CORNER, CHOCTAW NATION.

On the open prairie 12 miles southwest of Caddo, on second guide meridian, 29 miles south of land office base line.

Station mark: A wooden post, 6 inches square, projecting 18 inches above ground, with 5 grooves cut on north side and 1 groove on south side; R. 8 E., and S. 25 on northwest side, R. 9 E., and S. 31 on southeast side, T. 5 S., and S. 30 on northeast side, and S. 36 on southwest side.

[Latitude, 34° 05′ 05.83″. Longitude, 96° 24′ 25.52″.]

To station—	Azimuth.	Back azimuth.	Log. distance.
	° ′ ″	° ′ ″	*Meters.*
Buffalo	193 26 58.11	13 28 19.33	4.2019780
Caddo	269 35 49.89	89 40 37.54	4.1192421

CADDO, CHOCTAW NATION.

On the first hill south of Caddo, being about 3 miles south of that town and 2 miles east of Missouri, Kansas and Texas Railway. The corner common to secs. 28, 29, 32, and 33, T. 5. S., R. 10 E., may be reached from the station by going due west 14.11 chains, thence S. 0° 02′ E. 5.70 chains.

Station mark: A sandstone post, 20 by 8 by 8 inches, set 15 inches in the ground, marked U. △ S.

[Latitude, 34° 05′ 08.52″. Longitude, 96° 15′ 52.23″.]

To station—	Azimuth.	Back azimuth.	Log. distance.
	° ′ ″	° ′ ″	*Meters.*
Standard section corner..	89 40 37.54	269 35 49.89	4.1192421
Buffalo	148 30 55.68	328 27 28.73	4.2568325
Giant	177 10 26.98	357 09 43.02	4.6067000
Bald	204 04 34.25	24 10 28.68	4.5957933
Forest	220 42 16.94	40 49 46.98	4.4969643
White Rock	239 47 08.75	60 06 18.14	4.7813130
Sugarloaf (2)	262 16 03.77	82 23 56.86	4.3389841

SUGARLOAF (2), CHOCTAW NATION.

On a sharp, bare peak 15 miles east of Caddo; a prominent and well-known landmark in that part of the nation. The corner common to secs. 14, 15, 22, and 23, T. 5 S., R. 12 E., may be reached from the station by going due east 25.90 chains, thence N. 0° 01′ W. 8.43 chains.

Station mark: A rock cairn 4 feet high.

[Latitude, 34° 06′ 43.04″. Longitude, 96° 01′ 48.35″.]

To station—	Azimuth.	Back azimuth.	Log. distance.
	° ′ ″	° ′ ″	*Meters.*
Caddo	82 23 56.86	262 16 03.77	4.3389841
Buffalo	112 00 07.96	291 48 46.96	4.5246785
Giant	147 53 10.47	327 44 31.13	4.6461276
Bald	170 36 45.32	350 34 44.75	4.5253280
Forest	176 58 53.14	356 58 28.94	4.3201576
White Rock	228 12 30.30	48 23 45.33	4.6141214
Goodland	277 38 34.00	97 53 16.15	4.6098760

WHITE ROCK, CHOCTAW NATION.

A high, flat mountain about 5 miles west of the St. Louis and San Francisco Railroad and 9 miles by road northwest of Rodney. The summit is level for several miles and covered with tall pine trees. The station is located near the northwest end of the summit, about one-fourth mile northwest of head of log chute and three-fourths mile northwest of Herndon's sawmill. The quarter corner between secs. 23 and 26, T. 2 S., R. 15 E., may be reached from the station by going due north 8.91 chains to section line, thence due west 1 chains. Theodolite elevated 60 feet.

Station mark: A flint rock 1 foot square on top, 3½ feet long, set 2 feet in the ground. Rock marked U. △ S.

[Latitude, 34° 21′ 30.92″. Longitude, 95° 41′ 48.46″.]

To station—	Azimuth.	Back azimuth.	Log. distance.
	° ′ ″	° ′ ″	*Meters.*
Sugarloaf	48 23 45.33	228 12 30.30	4.6141214
Caddo	60 06 18.14	239 47 08.75	4.7813130
Forest	78 33 36.05	258 21 55.11	4.5109320
Goodland	343 43 15.78	163 46 46.13	4.5343770

GOODLAND, CHOCTAW NATION.

On a high, flat prairie ridge owned by Tom Self, 4 miles west of Goodland and 1 mile north of road from Goodland to forks of Boggy Creek. From quarter corner between secs. 1 and 2, T. 6 S., R. 16 E. station bears S. 79° 25′ W., 11.68 chains distant.

Station mark: Shell rocks piled around foot of tall signal pole.

[Latitude, 34° 03′ 44.44″. Longitude, 95° 35′ 34.34″.]

To station—	Azimuth.	Back azimuth.	Log. distance.
	° ′ ″	° ′ ″	*Meters.*
Sugarloaf (2)	97 53 16.15	277 38 34.00	4.6098760
White Rock	163 46 46.13	343 43 15.78	4.5343770

GULLY, CHOCTAW NATION.

A timbered hill in northwestern portion of Choctaw Nation.

The station was not occupied, but all timber was cut down in 1895, leaving a lone tree as a signal. The corner common to secs. 9, 10, 15, and 16, T. 4 N., R. 9 E., may be reached from station by going due north 97 links and due east 32.10 chains.

Station mark: Lone signal tree.

[Latitude, 34° 49′ 32.06″. Longitude, 96° 20′ 46.96″.]

To station—	Azimuth.	Back azimuth.	Log. distance.
	° ′ ″	° ′ ″	*Meters.*
Sulser	7 21 36	187 20 58	4.12057
Ninas	311 15 30	131 19 28	4.14981

SHAWNEE, CHOCTAW NATION.

On a high timbered point about 3 miles north from where Choctaw, Oklahoma and Gulf Railroad crosses Coal Creek. The corner common to secs. 2, 3, 10, and 11, T. 5 N., R. 11 E., may be reached from station by going S. 43° 43′ W. 3.79½ chains. Theodolite elevated 36 feet.

U. S.
Station mark: Rock marked +
G. S.

[Latitude, 34° 55′ 40.88″. Longitude, 96° 07′ 23.07″.]

To station—	Azimuth.	Back azimuth.	Log. distance.
	° ′ ″	° ′ ″	*Meters.*
Dalton	358 42 13.02	178 42 21.97	4.2417852
Ninas	25 26 16.86	205 22 34.79	4.3598040
Hawkins	93 34 21.35	273 24 19.90	4.4265922
Bruner	126 10 31.06	306 02 01.66	4.4451958
Blanket	180 59 59.13	1 00 09.04	4.3988600
Scipio	217 05 12.59	37 11 31.71	4.4430075
Lost	281 42 00.50	101 53 54.14	4.5099472
Whaleback	303 17 09.95	123 22 21.34	4.2187031

HAWKINS, CREEK NATION.

On a timbered ridge about 5 miles north of Allen, about 1 mile north of Canadian River, and 1 mile west from Mr. Hawkins's residence. Station is 4.2 chains north of town line between Ts. 5 and 6 N., R. 8 E., and 37.5 chains east of line between secs. 35 and 36. Theodolite elevated 65 feet.

U. S.
Station mark: Rock marked +
G. S.

[Latitude, 34° 56′ 33.63″. Longitude, 96° 24′ 53.39″.]

To station—	Azimuth.	Back azimuth.	Log. distance.
	° ′ ″	° ′ ″	*Meters.*
Wewoka	165 19 14.59	345 15 32.26	4.5860074
Bruner	195 31 05.57	15 32 38.63	4.1864090
Shawnee	273 24 19.90	93 34 21.35	4.4265922
Ninas	322 51 47.81	142 58 06.97	4.4466067

BRUNER, CREEK NATION.

On a timbered ridge about 2 miles east from Holden, a small town on Choctaw, Oklahoma and Gulf Railroad, and three-fourths mile north of Berry Bruner's residence. The corner common to secs. 16, 17, 20, and 21, T. 7 N., R. 9 E., may be reached from station by going due west 1.95 chains, thence due south 20.05 chains. Theodolite elevated 50 feet.

U. S.
Station mark: Rock marked +
G. S.

[Latitude, 35° 04′ 33.89″. Longitude, 96° 22′ 11.17″.]

To station—	Azimuth.	Back azimuth.	Log. distance.
	° ′ ″	° ′ ″	*Meters.*
Hawkins	15 32 38.63	195 31 05.57	4.1864090
Wewoka	148 20 51.31	328 15 35.18	4.4220464
Blanket	249 18 47.67	69 27 28.44	4.3890809

BLANKET, CREEK NATION.

On a timbered ridge about 13 miles southwest from Proctor and about 1 mile south from Allen-Eufaula road at point where road enters the hills going southwest. The corner common to secs. 22, 23, 26, and 27, T. 8 N., R. 11 E., may be reached from station by going due west 22.70 chains, thence due south 47.96 chains. Theodolite elevated 38 feet.

U. S.
Station mark: Rock marked +
G. S.

[Latitude, 35° 09′ 13.74″. Longitude, 96° 07′ 05.80″.]

To station—	Azimuth.	Back azimuth.	Log. distance.
	° ′ ″	° ′ ″	*Meters.*
Bruner	69 27 28.44	249 18 47.67	4.3890809
Wewoka	110 46 03.01	290 32 04.48	4.5944177
Bean	169 46 42.33	349 44 31.44	4.5078207
Rentie	194 21 08.03	14 24 34.36	4.5600038
Tiger	233 37 59.83	53 46 48.92	4.4590231
Scipio	280 11 06.93	100 17 17.19	4.2187340
Shawnee	1 00 09.04	180 59 59.13	4.3988600

SCIPIO, CHOCTAW NATION.

On a prominent wooded butte on south side of Canadian River just west of the mouth of Scipio Creek. It is best approached from the southeast side. The quarter corner on line between secs. 33 and 34, T. 8 N., R. 13 E., may be reached from station by going due east 45.25 chains, thence due south 19.15 chains.

U. S.
Station mark: Rock marked +
G. S.

[Latitude, 35° 07′ 38.31″. Longitude, 95° 56′ 22.54″.]

To station—	Azimuth.	Back azimuth.	Log. distance.
	° ′ ″	° ′ ″	*Meters.*
Shawnee	37 11 31.71	217 05 12.59	4.4430075
Blanket	100 17 17.19	280 11 06.93	4.2187340
Tiger	199 06 26.88	19 09 04.84	4.3251235
Badger	218 01 30.50	38 08 36.40	4.4809116
Gaines	276 52 32.20	97 04 54.93	4.5178375
Lost	332 33 47.99	152 39 24.59	4.5098914
Whaleback	5 24 02.14	185 22 55.57	4.4960782

GAINES, CHOCTAW NATION.

On a long wooded ridge about 10 miles northeast of McAlester and 7 miles southeast of South Canadian. A wagon road was cut through the woods to station from north end of ridge. The quarter corner to secs. 10 and 14, T. 7 N., R 16 E., may be reached from station by going due south 22.51 chains, thence due west 19.55 chains. Theodolite elevated 30 feet.

U. S.
Station mark: Rock marked +
G. S.

[Latitude, 35° 05′ 28.40″. Longitude, 95° 34′ 51.13″.]

To station—	Azimuth.	Back azimuth.	Log. distance.
	° ′ ″	° ′ ″	*Meters.*
Lost	35 55 03.63	215 48 19.74	4.4843524
Scipio	97 04 54.93	276 52 32.20	4.5178375
Tiger	133 03 04.79	312 53 18.25	4.5462527
Badger	153 20 57.63	333 15 38.62	4.4933600
Checotah	182 27 43.81	2 28 21.63	4.5851466
Hartshorne	358 24 31.69	178 24 52.33	4.5183389
Tucker Knob	275 30 53.06	95 40 05.60	4.3886690
Enterprise	226 00 53.24	46 07 03.25	4.3536994

HARTSHORNE, CHOCTAW NATION.

On a flat, heavily wooded mountain about 4 miles south of Hartshorne, a town on the Choctaw, Oklahoma and Gulf Railroad. Most of the timber was cut down in April, 1895.

Station mark: Tall pine signal tree.

[Latitude, 34° 47′ 38.36″. Longitude, 95° 34′ 15.10″.]

To station—	Azimuth.	Back azimuth.	Log. distance.
	° ′ ″	° ′ ″	*Meters.*
Hewitt	35 14 24.67	215 09 04.93	4.3944219
Lost	113 44 21.12	293 37 18.15	4.3127665
Gaines	178 24 52.33	358 24 31.69	4.5183389
Tucker Knob	217 26 30.29	37 35 20.15	4.5861956
Redoak	234 09 44.63	54 23 35.08	4.6567634
Dexter	326 03 29.37	146 08 49.37	4.4091583

BADGER, CREEK NATION.

On a high prairie point locally known as Badger Mountain, 10 miles west of Eufaula. The corner common to secs. 8, 9, 16, and 17, T. 10 N., R. 15 E., may be reached from station by going due east 4.85 chains to the north-south line between secs. 16 and 17, thence due north 33.14 chains to corner.

Station mark: Rock marked $\overset{\text{U. S.}}{\underset{\text{G. S.}}{+}}$

[Latitude, 35° 20′ 31.26″. Longitude, 95° 44′ 04.31″.]

To station—	Azimuth.	Back azimuth.	Log. distance.
	° ′ ″	° ′ ″	*Meters.*
Scipio	38 08 36.40	218 01 30.50	4.4809116
Tiger	71 52 39.46	251 48 11.00	4.0913890
Council Hill	175 51 06.08	355 50 26.81	4.3724920
Checotah	235 44 48.55	55 50 46.86	4.2760000
Gaines	333 15 38.62	153 20 57.63	4.4933600
Chimney	214 51 02.85	35 00 51.93	4.6497068

TIGER, CREEK NATION.

On a wooded ridge, about 3 miles north from Cummings's store, which is 20 miles from Eufaula, on Eufaula-Wetumka road. The corner common to secs. 29, 30, 31, and 32, T. 10 N., R. 14 E., may be reached from station by going due east 30.68 chains to north-south line between secs. 29 and 30, thence due north 15.16 chains to corner. Theodolite elevated 40 feet.

U. S.
Station mark: Rock marked +
G. S.

[Latitude, 35° 18′ 26.45″. Longitude, 95° 51′ 48.61″.]

To station—	Azimuth.	Back azimuth.	Log. distance.
	° ′ ″	° ′ ″	*Meters.*
Scipio	19 09 04.84	199 06 26.88	4.3251235
Blanket	53 46 48.92	233 37 59.83	4.4590231
Rentie	142 06 28.55	322 01 04.10	4.3616769
Council Hill	200 03 04.43	20 06 54.34	4.4643900
Badger	251 48 11.00	71 52 39.46	4.0913890
Gaines	312 53 18.25	133 03 04.79	4.5462527

RENTIE, CREEK NATION.

On a prominent mountain, 4 or 5 miles east from Morris Rentie's house. Mr. Rentie lives 14 miles from Okmulgee, on Okmulgee-McDermott road. Theodolite elevated 38 feet.

U. S.
Station mark: Rock marked +
G. S.

[Latitude, 35° 28′ 14.98″. Longitude, 96° 01′ 08.82″.]

To station—	Azimuth.	Back azimuth.	Log. distance.
	° ′ ″	° ′ ″	*Meters.*
Blanket	14 24 34.36	194 21 08.03	4.5600038
Bean	76 43 08.80	256 37 30.32	4.1795973
McDermott	93 54 27.56	273 44 35.08	4.4114903
Buck	183 58 12.43	3 58 59.30	4.4656679
Council Hill	248 59 13.94	69 08 29.82	4.4118748
Tiger	322 01 04.10	142 06 28.55	4.3616769

BEAN, CREEK NATION.

On the highest part of a timbered ridge, 7 miles southwest from Morris Rentie's and 4 miles northeast from McDermott. The corner common to secs. 7, 8, 17, and 18, T. 11 N., R. 11 E., may be reached from station by going S. 51° 08′ E., 29.53 chains. Theodolite elevated 38 feet.

U. S.
Station mark: Rock marked +
G. S.

[Latitude, 35° 26′ 21.88″. Longitude, 96° 10′ 52.32″.]

To station—	Azimuth.	Back azimuth.	Log. distance.
	° ′ ″	° ′ ″	*Meters.*
Wewoka	60 11 47.16	239 59 56.76	4.5533090
McDermott	115 18 38.41	295 14 24.69	4,0861590
Philips	161 33 41.15	341 29 17.64	4.5559096
Slicker	185 56 33.15	5 58 23.18	4.6605192
Buck	207 04 12.40	27 10 38.80	4.5642776
Rentie	256 37 30.32	76 43 08.80	4.1795973
Blanket	349 44 31.44	169 46 42.33	4.5078207

M'DERMOTT, CREEK NATION.

On a high prairie ridge, 7 miles northwest from McDermott. The corner common to secs. 13, 18, 19, and 24, T. 12 N., R. 9 E., may be reached from station by going due north 40 chains, thence S. 88° E. 15.80 chains.

U. S.
Station mark: Rock marked +
G. S.

[Latitude, 35° 29′ 10.83″. Longitude, 96° 18′ 09.63″.]

To station—	Azimuth.	Back azimuth.	Log. distance.
	° ′ ″	° ′ ″	*Meters.*
Wewoka	40 57 33.57	220 49 55.98	4.4838314
Philips	179 13 51.81	359 13 42.78	4.4610444
Buck	225 12 47.84	45 23 29.08	4.5910136
Rentie	273 44 35.08	93 54 27.56	4.4114903
Bean	295 14 24.69	115 18 38.41	4.0861590

PHILIPS, CREEK NATION.

On the highest point of a ridge 2½ miles southwest of Philipsburg. The quarter corner between secs. 24 and 25, T. 15 N., R. 9 E., may be reached from station by going due north 46.50 chains, thence S. 80° 30′ W. 4.15 chains. Theodolite elevated 35 feet.

U. S.
Station mark: Rock marked +
G. S.

[Latitude, 35° 44′ 48.79″. Longitude, 96° 18′ 25.07″.]

To station—	Azimuth.	Back azimuth.	Log. distance.
	° ′ ″	° ′ ″	*Meters.*
Phantom	185 08 22.08	5 09 32.36	4.5250097
Slicker	234 39 23.83	54 45 39.10	4.2952760
Buck	272 55 34.92	93 06 27.21	4.4487212
Bean	341 29 17.64	161 33 41.15	4.5559096
McDermott	359 13 42.78	179 13 51.81	4.4610444

SLICKER, CREEK NATION.

On the highest point of a timbered ridge 10 miles south of Sapulpa. The corner common to secs. 22, 23, 26, and 27, T. 16 N., R. 11 E., may be reached from station by going due east 35.19 chains to north-south line, thence due south 37.13 chains. Theodolite elevated 30 feet.

U. S.
Station mark: Rock marked +
G. S.

[Latitude, 35° 50′ 58.77″. Longitude, 96° 07′ 43.51″.]

To station—	Azimuth.	Back azimuth.	Log. distance.
	° ′ ″	° ′ ″	*Meters.*
Bean	5 58 23.18	185 56 33.15	4.6605192
Philips	54 45 39.10	234 39 23.83	4.2952760
Phantom	149 16 21.79	329 11 15.53	4.4075133
Red Fork	196 32 28.97	16 35 52.47	4.4832632
Prairie	212 57 39.81	33 00 57.80	4.1916511
Concharty	268 29 43.14	88 42 30.97	4.5172609
Buck	317 09 01.96	137 13 39.87	4.2445088

COUNCIL HILL, CREEK NATION.

On the highest point of a timbered ridge, near the old Creek camping ground known as Council Hill, 20 miles northwest of Checotah, 16 miles southeast of Okmulgee. From closing corner to secs. 5 and 6, T. 12 N., R. 15 E., station may be reached by going N. 46° 01′ W. 15.47 chains. Theodolite elevated 40 feet.

U. S.
Station mark: Rock marked +
G. S.

[Latitude, 35° 33′ 14.29″. Longitude, 95° 45′ 12.03″.]

To station—	Azimuth.	Back azimuth.	Log. distance.
	° ′ ″	° ′ ″	*Meters.*
Tiger	20 06 54.34	200 03 04.43	4.4643900
Rentie	69 08 29.82	248 59 13.94	4.4118748
Buck	132 10 36.83	312 02 06.04	4.4729877
Concharty	178 15 58.87	358 15 35.01	4.5266554
Chimney	244 15 19.04	64 25 49.08	4.4801495
Checotah	306 39 30.76	126 46 09.33	4.3340941
Badger	355 50 26.81	175 51 06.08	4.3724920

CHECOTAH, CREEK NATION.

On a prairie hill 3 miles southwest of Checotah, a town on the Missouri, Kansas and Texas Railway. From quarter corner on line between secs. 12 and 13, T. 11 N., R. 16 E., station bears N. 38° 55′ E. 17.80 chains distant.

Station mark: A rock marked $\overset{\text{U. S.}}{\underset{\text{G. S.}}{+}}$

[Latitude, 35° 26′ 15.65″. Longitude, 95° 33′ 45.61″.]

To station—	Azimuth.	Back azimuth.	Log. distance.
	° ′ ″	° ′ ″	*Meters.*
Badger	55 50 46.86	235 44 48.55	4.2760000
Council Hill	126 46 09.33	306 39 30.76	4.3340941
Chimney	200 56 57.80	21 00 47.78	4.4443800
Gaines	2 28 21.63	182 27 43.81	4.5851466
Tucker Knob	330 54 23.74	151 03 00.85	4.6691536
Enterprise	327 20 21.69	147 25 55.37	4.4319011
Robinson	290 25 39.72	110 35 09.18	4.4230683
Nebo	240 27 44.88	60 34 14.95	4.2891939

CHIMNEY, CREEK NATION.

On the highest point of a prairie hill locally known as Chimney Mountain, 8 or 10 miles southwest of Muscogee.

Station mark: A tree wired up, to which all angles are referred.

Reference mark: Rock marked $\overset{\text{U. S.}}{\underset{\text{G. S.}}{+}}$ 5 feet west-northwest of tree.

[Latitude, 35° 40′ 18.52″. Longitude, 95° 27′ 10.08″.]

To station—	Azimuth.	Back azimuth.	Log. distance.
	° ′ ″	° ′ ″	*Meters.*
Checotah	21 00 47.78	206 56 57.80	4.4443800
Badger	35 00 51.93	214 51 02.85	4.6497068
Council Hill	64 25 49.08	244 15 19.04	4.4801495
Concharty	126 08 47.59	305 57 51.63	4.5425065
Grand	230 26 08.37	50 35 12.03	4.4812237
Choate	270 04 36.12	90 27 02.85	4.7640609
Nebo	336 58 36.97	157 01 17.93	4.2507681

CONCHARTY, CREEK NATION.

On a high knob in the southeastern portion of the Concharty Mountains, 4 miles northeast of Concharty. From corner common to secs. 13, 18, 19, and 24, on eastern boundary of T. 16 N., R. 14 E., station bears N. 63° E., 4 chains distant. Theodolite elevated 50 feet.

U. S.
Station mark: Rock marked +
G. S.

[Latitude, 35° 51′ 24.53″. Longitude, 95° 45′ 52.43″.]

To station—	Azimuth.	Back azimuth.	Log. distance.
	° ′ ″	° ′ ″	*Meters.*
Council Hill	358 15 35.01	178 15 58.87	4.5266554
Buck	56 57 41.33	236 49 32.51	4.3988766
Slicker	88 42 30.97	268 29 43.14	4.5172608
Prairie	116 42 33.87	296 33 02.96	4.4362032
Weer	175 20 16.00	355 19 30.49	4.3773732
Barber	247 34 42.92	67 45 53.06	4.5210429
Grand	271 14 31.71	91 34 33.92	4.7120103
Chimney	305 57 51.63	126 08 47.59	4.5425065

BUCK, CREEK NATION.

On a high ridge 9 miles a little west of north of Okmulgee. The corner common to secs. 35, 36, 1, and 2, T. 15 N., R. 12 E., may be reached from station by going due west 26 links to north-south line, thence due south 38.38 chains. Theodolite elevated 30 feet.

U. S.
Station mark: Rock marked +
G. S.

[Latitude, 35° 44′ 00.81″. Longitude, 95° 59′ 48.31″.]

To station—	Azimuth.	Back azimuth.	Log. distance.
	° ′ ″	° ′ ″	*Meters.*
Rentie	3 58 59.30	183 58 12.43	4.4656679
Bean	27 10 38.80	207 04 12.40	4.5642776
McDermott	45 23 29.08	225 12 47.84	4.5910136
Philips	93 06 27.21	272 55 34.92	4.4487212
Slicker	137 13 39.87	317 09 01.96	4.2445088
Prairie	172 25 24.99	352 24 04.40	4.4174915
Concharty	236 49 32.51	56 57 41.33	4.3988766
Council Hill	312 02 06.04	132 10 36.83	4.4729877

MERCHANT, CREEK NATION.

On a very prominent prairie hill about 1½ miles northeast from Inola, a station on the St. Louis, Iron Mountain and Southern Railway. From quarter corner on line between secs. 9 and 10, T. 19 N., R. 17 E., station bears N. 54° 30′ E., 41.07 chains distant.

Station mark: Rock monument 7 feet high.

[Latitude, 36° 08′ 42.58″. Longitude, 95° 29′ 07.50″.]

To station—	Azimuth.	Back azimuth.	Log. distance.
	° ′ ″	° ′ ″	*Meters.*
Weer	73 08 57.47	252 58 19.50	4.4518697
Grand	321 38 24.35	141 48 40.13	4.6270376
Barber	344 09 40.46	164 11 49.69	4.3043975
McGinnis	134 01 12.44	313 53 07.78	4.4539608
Corbett	189 12 37.68	9 13 03.50	3.8340395
Saline	266 22 21.40	86 38 36.97	4.6170996

WEER, CREEK NATION.

On the highest one of several small prairie hills 6 miles north of Weer post-office and store. The corner common to secs. 1, 2, 11, and 12, T. 18 N., R. 14 E., may be reached from station by going due east 34.64 chains to north-south line, thence south 52.68 chains.

Station mark: Signal tree.

[Latitude, 36° 04′ 15.01″. Longitude, 95° 47′ 10.07″.]

To station—	Azimuth.	Back azimuth.	Log. distance.
	° ′ ″	° ′ ″	*Meters.*
Prairie	62 52 06.41	242 43 19.61	4.4017803
Red Fork	101 46 24.03	281 37 41.43	4.3553486
Merchant	252 58 19.50	73 08 57.47	4.4518697
Concharty	355 19 30.49	175 20 15.97	4.3773732
Tulsa	122 49 00.53	302 39 44.40	4.4476239
McGinnis	193 10 20.92	13 12 56.02	4.4585858
Dog Creek	221 35 43.95	41 48 22.82	4.6830193
Corbett	241 53 34.36	62 04 38.55	4.5037586

PRAIRIE, CREEK NATION.

On a prairie knob 5 miles east of Sapulpa. The corner common to secs. 9, 10, 15, and 16, T. 17 N., R. 12 E., may be reached from station by going due east 28.30 chains to north-south line, thence south 41.54 chains.

U. S.
Station mark: Rock marked +
G. S.

[Latitude, 35° 58′ 01.88″. Longitude, 96° 02′ 05.92″.]

To station—	Azimuth.	Back azimuth.	Log. distance.
	° ′ ″	° ′ ″	*Meters.*
Slicker	33 00 57.80	212 57 39.81	4.1916511
Phantom	112 34 54.96	292 26 29.81	4.3672550
Red Fork	180 46 50.04	0 46 55.21	4.2074900
Weer	242 43 19.61	62 52 06.41	4.4017803
Concharty	296 33 02.96	116 42 33.87	4.4362032
Buck	352 24 04.40	172 25 24.99	4.4174915
Tulsa	177 28 19.97	357 27 52.19	4.4267742

RED FORK, CREEK NATION.

On a timbered ridge three-fourths mile west from Red Fork. The corner common to secs. 21, 22, 27, and 28, T. 19 N., R. 13 E., may be reached from station by going due east 17.95 chains to north-south line, thence south 41.80 chains. Theodolite elevated 30 feet.

U. S.
Station mark: Rock marked +
G. S.

[Latitude, 36° 06′ 44.99″. Longitude, 96° 01′ 57.14″.]

To station—	Azimuth.	Back azimuth.	Log. distance.
	° ′ ″	° ′ ″	*Meters.*
Prairie	00 46 53.21	180 46 50.04	4.2074900
Slicker	16 35 52.47	196 32 28.97	4.4832632
Phantom	71 43 14.27	251 34 43.06	4.3595162
Weer	281 37 41.43	101 46 24.03	4.3553486

PHANTOM, CREEK NATION.

On the highest part of a timbered ridge 15 miles from Red Fork, 5 miles southwest of Mr. Rockhammer's house. The corner common to secs. 7, 8, 17, and 18, T. 18 N., R. 10 E., may be reached from station by going due west 24.90 chains to north-south line, thence south 2.25 chains. Theodolite elevated 40 feet.

Station mark: Rock marked $\overset{\text{U. S.}}{\underset{\text{G. S.}}{+}}$.

[Latitude, 36° 02′ 51.26″. Longitude, 96° 16′ 25.20″.]

To station—	Azimuth.	Back azimuth.	Log. distance.
	° ′ ″	° ′ ″	*Meters.*
Philips	5 09 32.36	185 08 22.08	4.5250097
Red Fork	251 34 43.06	71 43 14.27	4.3595162
Prairie	292 26 29.81	112 34 54.96	4.3672550
Slicker	329 11 15.53	149 16 21.79	4.4075133

WEWOKA, SEMINOLE NATION.

On a prominent wooded hill 8 miles north-northwest of Wewoka, from which all trees have been cut down, excepting one, which was trimmed and used as a signal. The corner common to secs. 1, 2, 11, and 12, T. 9 N., R. 7 E., may be reached from station by going due south 16.92 chains to east-west line, thence west 35.06 chains on line to corner.

Station mark: Lone signal tree.

Reference mark: Rock marked $\overset{\text{U. S.}}{\underset{\text{G. S.}}{+}}$ 3 feet west of signal tree.

[Latitude, 35° 16′ 43.53″. Longitude, 96° 31′ 19.91″.]

To station—	Azimuth.	Back azimuth.	Log. distance.
	° ′ ″	° ′ ″	*Meters.*
McDermott	220 49 55.98	40 57 33.57	4.4838314
Bean	239 59 56.76	60 11 47.16	4.5533090
Blanket	290 32 04.48	110 46 03.01	4.5944177
Bruner	328 15 35.18	148 20 51.31	4.4220467
Hawkins	345 15 32.26	165 19 14.59	4.5860074

TURKEY SPRING, CHICKASAW NATION.

On a flat timbered ridge 5 miles a little east of north from Iona post-office, on Iona-Hart road, about 54 yards east from road. The quarter-section corner between secs. 4 and 9, T. 2 N., R. 3 E., true azimuth of which is 56° 26′, is distant from station 514 feet. Theodolite elevated 44 feet.

Station mark: A stone post, 26 by 6 by 6 inches, set 24 inches in the ground, with copper bolt marked $\overset{\text{U. S.}}{\underset{\text{G. S.}}{+}}$ sunk in center of top.

[Latitude, 33° 40′ 00.72″. Longitude, 96° 59′ 29.59″.]

To station—	Azimuth.	Back azimuth.	Log. distance.
	° ′ ″	° ′ ″	*Meters.*
Center	210 40 45.68	30 43 48.54	4.2039410
Double Mound	265 27 22.42	85 35 24.28	4.3350359
Hickory Grove	315 37 36.52	135 42 22.89	4.2644222
Falls	27 32 57.77	207 27 36.67	4.4950993
Bounds	48 39 51.04	228 29 05.61	4.5877258
Table Hills	90 51 30.05	270 34 20.49	4.6635548
Washington	142 58 42.56	322 52 22.28	4.4491675

HICKORY GROVE, CHICKASAW NATION.

On summit of timbered hill 1¼ miles southeast from town of Hickory. Point is locally known as Hickory Grove. The corner common to secs. 13, 14, 23, and 24, T. 1 N., R. 4 E., true azimuth of which is 255° 30′, is distant from station 2,320 feet. Theodolite elevated 40 feet.

Station mark: A rock found in place about 2 feet square, 3 or 4 inches above ground, a hole drilled 1 inch deep near center of rock and filled with lead. A large $\overset{\text{U. S.}}{\underset{\text{G. S.}}{+}}$ cut on rock around center.

[Latitude, 34° 32′ 53.99″. Longitude, 96° 51′ 05.38″.]

To station—	Azimuth.	Back azimuth.	Log. distance.
	° ′ ″	° ′ ″	*Meters.*
Mill Creek	5 18 49.48	185 18 11.56	4.2667531
Falls	61 59 09.76	241 49 03.68	4.4908862
Turkey Spring	135 42 22.89	315 37 36.52	4.2644222
Double Mound	210 27 07.44	30 30 22.15	4.2359485
Kennedy	224 48 45.67	44 53 11.02	4.2274279
Pontotoc	278 53 40.55	99 02 20.76	4.3746222
Reagan	316 17 48.34	136 23 47.21	4.3699816

REAGAN, CHICKASAW NATION.

On high prairie point in northwest corner of Harris's pasture, about 4½ miles northeast from Reagan post-office. About 1½ miles west from Tishomingo-Stonewall road at point 11 miles from (Old) Tishomingo. The corner common to secs. 9, 10, 15, and 16, T. 2 S., R. 6 E., true azimuth of which is 318° 39′, is distant from station 2,312.6 feet.

Station mark: A stone post, 30 by 7 by 7 inches, set 27 inches in the ground, with copper bolt marked $\overset{\text{U. S.}}{\underset{\text{G. S.}}{+}}$ sunk in center of top.

[Latitude, 34° 23′ 43.55″. Longitude, 96° 40′ 31.32″.]

To station—	Azimuth.	Back azimuth.	Log. distance.
	° ′ ″	° ′ ″	*Meters.*
Teller	7 30 36.39	187 29 30.27	4.3615846
Provence	47 23 52.41	227 12 48.55	4.6131505
Mill Creek	85 27 00.60	265 20 24.64	4.2544722
Hickory Grove	136 23 47.21	316 17 48.34	4.3699816
Pontotoc	208 35 59.02	28 38 39.50	4.1793967
Giant	260 19 57.29	80 33 09.27	4.5596544

MILL CREEK, CHICKASAW NATION.

On highest point of prairie ridge, 2 miles south of and visible from Mill Creek post-office. Point is covered with limestone rock. The corner common to secs. 9, 10, 15, and 16, T. 2 S., R. 4 E., true azimuth of which is 135° 02′, is distant from station 4,295 feet.

Station mark: A stone post, 26 by 6 by 6 inches, set 24 inches in the ground, with copper bolt marked $\overset{\text{U. S.}}{\underset{\text{G. S.}}{+}}$ sunk in center of top.

[Latitude, 34° 22′ 56.75″. Longitude, 96° 52′ 12.38″.]

To station—	Azimuth.	Back azimuth.	Log. distance.
	° ′ ″	° ′ ″	*Meters.*
Provence	24 54 06.30	204 49 37.24	4.4635652
Criner	46 44 39.50	226 33 22.63	4.6265169
Falls	98 33 05.83	278 23 38.88	4.4135521
Hickory Grove	185 18 11.56	5 18 49.48	4.2667531
Reagan	265 20 24.64	85 27 00.60	4.2544722
Teller	324 59 42.62	145 05 11.43	4.4158821

KENNEDY, CHICKASAW NATION.

On high, bald ridge about 8 miles west from Stonewall. The Stonewall-Roff road passes within 50 yards of station at point 8 miles from former. Station is on the north side of fence. The quarter-section corner between secs. 7 and 12, T. 2 N., Rs. 5 and 6 E., true azimuth of which is 183° 55′, is distant from station 900 feet.

Station mark: A stone post, 30 by 8 by 8 inches, set 27 inches in the ground, with a copper bolt marked $\overset{\text{U. S.}}{\underset{\text{G. S.}}{+}}$ sunk in center of top.

[Latitude, 34° 39′ 22.41″. Longitude, 96° 43′ 18.12″.]

To station—	Azimuth.	Back azimuth.	Log. distance.
	° ′ ″	° ′ ″	*Meters.*
Hickory Grove	44 53 11.02	224 48 45.67	4.2274279
Double Mound	132 09 30.35	312 08 19.53	3.6309344
Sulser	260 01 14.71	80 13 25.73	4.5210877
Pontotoc	323 43 23.24	143 47 38.93	4.2882158
Giant	299 41 26.54	119 56 15.74	4.6634185

CENTER, CHICKASAW NATION.

On prairie 1 mile south from Center-McGee road at point 5 miles from Center. Station is not on the highest point, but three-fourths mile south from it. The corner common to secs. 20, 21, 28, and 29, T. 4 N., R. 4 E., true azimuth of which is 217° 26′, is distant from station 2,791.8 feet.

Station mark: A stone post, 26 by 6 by 6 inches, set 24 inches in the ground, with a copper bolt marked $\overset{\text{U. S.}}{\underset{\text{G. S.}}{+}}$ sunk in center of top.

[Latitude, 34° 47′ 26.98″. Longitude, 96° 54′ 08.58″.]

To station—	Azimuth.	Back azimuth.	Log. distance.
	° ′ ″	° ′ ″	*Meters.*
Double Mound..........	311 59 42.83	132 04 42.52	4.2556380
Turkey Spring..........	30 43 48.54	210 40 45.68	4.2039410

DOUBLE MOUND, CHICKASAW NATION.

About 1 mile north of road between Stonewall and Roff at point 9 miles from Stonewall, on most northern of two prairie hills known as the Double Mounds. The corner common to secs. 34, 35, 2, and 3, Ts. 2 and 3 N., R. 5 E., true azimuth of which is 9° 24′, is distant from station 553.7 feet.

Station mark: A rock monument about 7 feet high.

[Latitude, 34° 40′ 55.51″. Longitude, 96° 45′ 22.61″.]

To station—	Azimuth.	Back azimuth.	Log. distance.
	° ′ ″	° ′ ″	*Meters.*
Kennedy................	312 08 19.53	132 09 30.35	3.6309344
Hickory Grove..........	30 30 22.15	210 27 07.44	4.2359485
Turkey Spring..........	85 35 24.28	265 27 22.42	4,3350359
Center.................	132 04 42.52	311 59 42.83	4.2556380

WASHINGTON, CHICKASAW NATION.

On high ridge, a portion of which is covered with timber, about 6 miles northeast from Paoli, a small town on the Gulf, Colorado and Santa Fe Railway, about 1 mile south from road between Johnson and Purcell, at point 7 miles west from former. The corner common to secs. 25, 26, 35, and 36, T. 5 N., R. 1 E., true azimuth of which is 185° 40′, is distant from station 290 feet.

Station mark: A stone post, 42 by 8 by 8 inches, set 38 inches in the ground, copper bolt marked $\overset{\text{U. S.}}{\underset{\text{G. S.}}{+}}$ sunk in center.

[Latitude, 34° 52′ 09.06″. Longitude, 97° 10′ 36.45″.]

To station—	Azimuth.	Back azimuth.	Log. distance.
	° ′ ″	° ′ ″	*Meters.*
Bounds.................	14 03 42.38	193 59 14.37	4.6948367
Table Hills............	53 08 07.47	232 57 15.59	4.5608000
Purcell................	122 35 38.65	302 26 22.45	4.4657995
Turkey Spring..........	322 52 22.28	142 58 42.56	4.4491675
Falls..................	357 04 13.48	177 05 10.62	4.7010726

PURCELL, CHICKASAW NATION.

On high prairie ridge 6 miles west from Purcell. The Purcell-Chickasha road passes 1 mile south from station. The quarter-section corner between secs. 7 and 8, T. 6 N., R. 2 W., true azimuth of which is 299° 18′, is distant from station 1,933 feet.

Station mark: A stone post, 26 by 7 by 7 inches, set 24 inches in the ground, with copper bolt marked $\overset{\text{U. S.}}{\underset{\text{G. S.}}{+}}$ sunk in center of top.

[Latitude, 35° 00′ 38.92″. Longitude, 97° 26′ 47.65″.]

To station—	Azimuth.	Back azimuth.	Log. distance.
	° ′ ″	° ′ ″	*Meters.*
Washington	302 26 22.45	122 35 38.65	4.4657995
Table Hills	6 38 31.16	186 36 52.96	4.5778655
Dibble	108 12 05.06	288 04 47.35	4.3082296

DIBBLE, CHICKASAW NATION.

On point with scattering timber near prairie, 2¾ miles northwest of Dibble. The quarter-section corner between secs. 19 and 20, T. 7 N., R. 4 E., true azimuth of which is 287° 41′, is distant from station 1,902 feet. Theodolite elevated 34 feet.

Station mark: A stone post, 30 by 6 by 6 inches, set 27 inches in the ground, with copper bolt marked $\overset{\text{U. S.}}{\underset{\text{G. S.}}{+}}$ sunk in center of top.

[Latitude, 35° 04′ 04.37″. Longitude, 97° 39′ 30.03″.]

To station—	Azimuth.	Back azimuth.	Log. distance.
	° ′ ″	° ′ ″	*Meters.*
Purcell	288 04 47.35	108 12 05.06	4.3082296
Table Hills	341 05 42.68	161 11 20.28	4.6665312
Marlow	28 28 13.04	208 19 49.32	4.6723677

MARLOW, CHICKASAW NATION.

On a sand hill covered with small black-jack trees about 5 miles northeast from Marlow, a town on Chicago, Rock Island and Pacific Railway. Road between Marlow and Rush Springs passes 2 miles west from station at point 4 miles from Marlow. Can be seen from both Marlow and Rush Springs. The corner common to secs. 25, 26, 35, and 36, T. 3 N., R. 7 W., true azimuth of which is 255° 43′, is distant from station 2,245 feet.

Station mark: A stone post, 30 by 7 by 7 inches, set 27 inches in the ground, with copper bolt marked $\overset{\text{U. S.}}{\underset{\text{G. S.}}{+}}$ sunk in center of top.

[Latitude, 34° 41′ 41.90″. Longitude, 97° 54′ 10.85″.]

To station—	Azimuth.	Back azimuth.	Log. distance.
	° ′ ″	° ′ ″	*Meters.*
Dibble	208 19 49.32	28 28 13.04	4.6723677
Table Hills	273 45 57.14	93 59 54.38	4.5744916
Velma	325 13 14.67	145 20 40.59	4.5463148

TABLE HILLS, CHICKASAW NATION.

On a high timbered ridge about 4 miles north from Foster post-office, about 1 mile southwest from a flat-topped prairie hill, the highest of several hills locally known as "The Table Hills." The corner common to secs. 2, 3, 10, and 11, T. 2 N., R. 3 E., true azimuth of which is 339° 25′, is distant from station 1,955.2 feet.

Station mark: A stone post, 30 by 6 by 6 inches, set 27 inches in the ground, with copper bolt marked $\overset{\text{U. S.}}{\underset{\text{G. S.}}{+}}$ sunk in center of top.

[Latitude, 34° 40′ 19.40″. Longitude, 97° 29′ 39.52″.]

To station—	Azimuth.	Back azimuth.	Log. distance.
	° ′ ″	° ′ ″	*Meters.*
Velma	33 34 32.37	213 28 03.67	4.5002213
Marlow	93 59 54.38	273 45 57.14	4.5744916
Dibble	161 11 20.28	341 05 42.68	4.6665312
Purcell	186 36 52.96	6 38 31.16	4.5778655
Washington	232 57 15.59	53 08 07.47	4.5608000
Turkey Spring	270 34 20.49	90 51 30.05	4.6635548
Falls	311 39 31.21	131 51 16.40	4.6284726
Bounds	326 45 23.84	146 51 44.83	4.4953517

BOUNDS, CHICKASAW NATION.

On high prairie ridge near center of Arbuckle Mountains, in pasture owned by Mr. Bounds, about 6 miles a little north of east from Elk post-office. Road between Woodford and Hennepin passes one-half mile east from station at point 7 miles from former. The corner common to secs. 21, 22, 27, and 28, T. 1 S., R. 1 W., true azimuth of which is 281° 02′, is distant from station 2,627 feet.

Station mark: A stone post, 26 by 7 by 7 inches, set 24 inches in the ground, with copper bolt marked $\overset{\text{U. S.}}{\underset{\text{G. S.}}{+}}$ sunk in center of top.

[Latitude, 34° 26′ 09.71″. Longitude, 97° 18′ 27.77″.]

To station—	Azimuth.	Back azimuth.	Log. distance.
	° ′ ″	° ′ ″	*Meters.*
Bomer	25 31 01.46	205 25 18.23	4.5591404
Velma	89 47 04.84	269 34 17.46	4.5396891
Table Hills	146 51 44.83	326 45 23.84	4.4953517
Washington	193 59 14.37	14 03 42.38	4.6948367
Turkey Spring	228 29 05.61	48 39 51.04	4.5877258
Falls	278 14 36.70	98 20 00.00	4.1689755
Criner	344 43 47.36	164 47 17.30	4.5595469

FALLS, CHICKASAW NATION.

On high timbered hill known as "East Timber Hill," about 7 miles a little west of south from Davis, on the Gulf, Colorado and Santa Fe Railway. All timber cut from summit except one tree, which was left for signal. The quarter corner between secs. 1 and 36, Ts. 1 and 2 S., R. 1 E., true azimuth of which is 151° 26′, is distant from station 1,232 feet.

Station mark: Lone signal tree.

[Latitude, 34° 25′ 00.67″. Longitude, 97° 08′ 55.90″.]

To station—	Azimuth.	Back azimuth.	Log. distance.
	° ′ ″	° ′ ″	*Meters.*
Criner	8 49 30.83	188 47 38.72	4.5219151
Bomer	44 44 19.94	224 33 14.71	4.6333908
Bounds	98 20 00.00	278 14 36.70	4.1689755
Table Hills	131 51 16.40	311 39 31.21	4.6284726
Washington	177 05 10.62	357 04 13.48	4.7010726
Turkey Spring	207 27 36.67	27 32 57.77	4.4950993
Hickory Grove	241 49 03.68	61 59 09.76	4.4908862
Mill Creek	278 23 38.88	98 33 05.83	4.4135521
Provence	335 57 43.01	156 02 39.05	4.5192812

VELMA, CHICKASAW NATION.

On northwest corner of high timbered ridge about 9 miles north from Loco post-office, about 3 miles south from Velma, a post-office on Wild Horse Creek, 5 miles below Arthur post-office. The corner common to secs. 25, 26, 35, and 36, T. 1 S., R. 5 W., true azimuth of which is 238° 08′, is distant from station 271 feet.

Station mark: A stone post, 30 by 7 by 7 inches, set 27 inches in the ground, with copper bolt marked $\overset{\text{U. S.}}{\underset{\text{G. S.}}{+}}$ sunk in center of top.

[Latitude, 34° 26′ 03.39″. Longitude, 97° 41′ 04.85″.]

To station—	Azimuth.	Back azimuth.	Log. distance.
	° ′ ″	° ′ ″	*Meters.*
Mud Creek	5 57 32.56	185 56 19.93	4.5025994
Marlow	145 20 40.59	325 13 14.67	4.5463148
Table Hills	213 28 03.67	33 34 32.37	4.5002213
Bounds	269 34 17.46	89 47 04.84	4.5396891
Bomer	329 28 46.75	149 35 48.03	4.5766564

MUD CREEK, CHICKASAW NATION.

On high prairie ridge in Washington's pasture, 13 miles south from Loco post-office and 7 miles west from Cornish post-office. Road between Loco and Oscar passes 50 yards east of station. The corner common to secs. 3, 4, 9, and 10, T. 5 S., R. 5 W., true azimuth of which is 347° 14′, is distant from station 1,800 feet.

Station mark: A stone post, 30 by 7 by 7 inches, set 27 inches in the ground, with copper bolt marked $\overset{\text{U. S.}}{\underset{\text{G. S.}}{+}}$ sunk in center of top.

[Latitude, 34° 08′ 56.49″. Longitude, 97° 43′ 13.77″.]

To station—	Azimuth.	Back azimuth.	Log. distance.
	° ′ ″	° ′ ″	*Meters.*
Velma	185 56 19.93	5 57 32.56	4.5025994
Bomer	272 10 17.03	92 18 29.13	4.3517708

BOMER, CHICKASAW NATION.

On a very flat timbered ridge 5 miles southwest from Hewitt post-office. Road between Hewitt and Atlee passes three-fourths mile north from station at point 4½ miles from Hewitt. About 2 miles southwest from point known as "Bomers Point." The corner common to secs. 1, 2, 11, and 12, T. 5 S., R 3 W., true azimuth of which is 218° 21′, is distant from station 1,419 feet.

Station mark: A stone post, 30 by 7 by 7 inches, set 27 inches in the ground, with copper bolt marked $\overset{\text{U. S.}}{\underset{\text{G. S.}}{+}}$ sunk in center of top.

[Latitude, 34° 08′ 27.98″. Longitude, 97° 28′ 37.03″.]

To station—	Azimuth.	Back azimuth.	Log. distance.
	° ′ ″	° ′ ″	*Meters.*
Mud Creek	92 18 29.13	272 10 17.03	4.3517708
Velma	149 35 48.03	329 28 46.75	4.5766564
Bounds	205 25 18.23	25 31 01.46	4.5591404
Falls	224 33 14.71	44 44 19.94	4.6333908
Criner	275 06 01.87	95 15 12.86	4.4025346

CRINER, CHICKASAW NATION.

On high prairie ridge 6 miles southwest from Ardmore. Road from Ardmore to Brook post-office passes within one-half mile of station at point where it crosses Hickory Creek. The station is south of this point, and can be seen from Ardmore. The quarter corner between secs. 15 and 16, T. 5 S., R. 1 E., true azimuth of which is 258° 06′, is distant from station 3,010 feet.

Station mark: A stone post, 24 by 7 by 7 inches, set 22 inches in the ground, with copper bolt marked $\overset{\text{U. S.}}{\underset{\text{G. S.}}{+}}$ sunk in center of top.

[Latitude, 34° 07′ 13.98″. Longitude, 97° 12′ 15.02″.]

To station—	Azimuth.	Back azimuth.	Log. distance.
	° ′ ″	° ′ ″	*Meters.*
Bomer	95 15 12.86	275 06 01.87	4.4025346
Bounds	164 47 17.30	344 43 47.36	4.5595469
Falls	188 47 38.72	8 49 30.83	4.5219151
Mill Creek	226 33 22.63	46 44 39.50	4.6265169
Provence	261 46 24.86	81 53 11.50	4.2732401
Marietta	333 55 54.13	153 59 48.74	4.3893686

MARIETTA, CHICKASAW NATION.

On a prominent prairie peak 2 miles southeast from town of Marietta on the Gulf, Colorado and Santa Fe Railway. The corner common to secs. 21, 22, 27, and 28, T. 8 S., R. 2 E., true azimuth of which is 148° 09′, is distant from station 1,777 feet.

Station mark: A rock monument 6 feet high.

[Latitude, 33° 55′ 19.18″. Longitude, 97° 05′ 15.67″.]

To station—	Azimuth.	Back azimuth.	Log. distance.
	° ′ ″	° ′ ″	*Meters.*
Criner	153 59 48.74	333 55 54.13	4.3893686
Provence	197 34 50.80	17 37 41.72	4.4133530
Cliff	253 36 40.99	73 48 51.42	4.5436688

PROVENCE, CHICKASAW NATION.

On a round prairie hill the most prominent of the prairie hills known as the "Yellow Hills." One mile southeast from Provence post-office. The corner common to secs. 4, 5, 8, and 9, T. 5 S., R. 3 E., true azimuth of which is 347° 49′, is distant from station 282 feet.

Station mark: A stone post, 30 by 7 by 7 inches, set 28 inches in the ground, with copper bolt marked $\overset{\text{U. S.}}{\underset{\text{G. S.}}{+}}$ sunk in center of top.

[Latitude, 34° 08′ 40.52″. Longitude, 97° 00′ 10.28″.]

To station—	Azimuth.	Back azimuth.	Log. distance.
	° ′ ″	° ′ ″	*Meters.*
Marietta	17 37 41.72	197 34 50.80	4.4133530
Criner	81 53 11.50	261 46 24.86	4.2732401
Falls	156 02 39.05	335 57 43.01	4.5192812
Mill Creek	204 49 37.24	24 54 06.30	4.4635652
Teller	259 26 15.23	79 36 11.42	4.4417207
Cliff	300 00 24.74	120 09 46.16	4.4726143

CLIFF, CHICKASAW NATION.

On a prairie ridge 2½ miles southwest from Cliff post-office, and about the same distance northeast from Kingston post-office. Road between Cliff and Kingston passes one-fourth mile from station. The corner common to secs. 19, 24, 25, and 30, T. 6 S., Rs. 5 and 6 E., true azimuth of which is 162° 15′, is distant from station 1,006.5 feet.

Station mark: A stone post, 30 by 7 by 7 inches, set 28 inches in the ground, with copper bolt marked $\overset{\text{U. S.}}{\underset{\text{G. S.}}{+}}$ sunk in center of top.

[Latitude, 34° 00′ 37.47″. Longitude, 96° 43′ 28.30″.]

To station—	Azimuth.	Back azimuth.	Log. distance.
	° ′ ″	° ′ ″	*Meters.*
Marietta	73 48 51.42	253 36 40.99	4.5436688
Provence	120 09 46.16	300 00 24.74	4.4726143
Teller	184 23 02.16	4 23 35.58	4.3004052

TELLER, CHICKASAW NATION.

On a high timbered ridge locally known as "Big Mush Mountain," 3½ miles a little west of south from Tishomingo and 1 mile east from Teller post-office. Ridge breaks off abruptly to the north and slopes gradually south. The corner common to secs. 19, 20, 29, and 30, T. 4 S., R. 6 E., true azimuth of which is 317° 11′, is distant from station 1,268 feet.

Station mark: A stone post, 30 by 7 by 7 inches, set 28 inches in the ground, with copper bolt marked $\overset{\text{U. S.}}{\underset{\text{G. S.}}{+}}$ sunk in center of top.

[Latitude, 34° 11′ 23.75″. Longitude, 96° 42′ 28.68″.]

To station—	Azimuth.	Back azimuth.	Log. distance.
	° ′ ″	° ′ ″	*Meters.*
Cliff	4 23 35.58	184 23 02.16	4.3004052
Provence	79 36 11.42	259 26 15.23	4.4417207
Mill Creek	145 05 11.43	324 59 42.62	4.4158821
Reagan	187 29 30.27	7 30 36.39	4.3615846

PONTOTOC, CHICKASAW NATION.

On a high bare limestone ridge 2½ miles northeast from Pontotoc post-office, 2 miles east from road between Stonewall and Pontotoc at a point 10 miles from Stonewall. The quarter corner between secs. 29 and 30, T. 1 N., R. 7 E., true azimuth of which is 45° 02′, is distant from station 981 feet.

Station mark: A copper bolt marked $\overset{\text{U. S.}}{\underset{\text{G. S.}}{+}}$ sunk in a large limestone rock found in place.

[Latitude, 34° 30′ 54.14″. Longitude, 96° 35′ 47.67″.]

To station—	Azimuth.	Back azimuth.	Log. distance.
	° ′ ″	° ′ ″	Meters.
Reagen	28 38 39.50	208 35 59.02	4.1793967
Hickory Grove	99 02 20.76	278 53 40.55	4.3746222
Kennedy	143 47 38.93	323 43 23.24	4.2882158
Sulser	224 47 54.19	44 55 48.06	4.4790149
Giant	284 10 03.04	104 20 35.63	4.4686086

ENTERPRISE, CHOCTAW NATION.

On a high hill in T. 9 N., R. 18 E., about 1 mile west from the town of Enterprise. All timber, with the exception of one tree, was cut from the summit of hill and the tree left standing was used for signal.

Station mark: Lone signal tree.

[Latitude, 35° 13′ 56.75″. Longitude, 95° 24′ 08.66″.]

To station—	Azimuth.	Back azimuth	Log. distance.
	° ′ ″	° ′ ″	Meters.
Gaines	46 07 03.25	226 00 53.27	4.3536994
Checotah	147 25 55.37	327 20 21.69	4.4319011
Nebo	184 14 11.38	4 15 06.44	4.5110605
Robinson	217 13 52.15	37 17 46.84	4.2292121
Cavanal	284 59 47.36	105 24 47.52	4.8347026
Tucker Knob	335 52 44.55	155 55 48.17	4.2960739
Choate	227 44 10.22	48 04 44.53	4.8592724

TUCKER KNOB, CHOCTAW NATION.

About 13 miles north from Wilburton, a small town on the Choctaw, Oklahoma and Gulf Railroad, and about 12 miles a little south of west from Sansbois. All timber with the exception of 1 tree was cut from summit of peak, and the tree left standing was used for signal. From the corner common to secs. 16, 17, and 21, T. 7 N., R. 19 E., station may be reached by going due south 1,095 feet, thence due west 122.6 feet.

Station mark: Lone signal tree.

[Latitude, 35° 04′ 11.03″. Longitude, 95° 18′ 49.74″.]

To station—	Azimuth.	Back azimuth.	Log. distance.
	° ′ ″	° ′ ″	*Meters.*
Gaines	95 40 05.62	275 30 53.09	4.3886687
Checotah	151 03 00.85	330 54 23.74	4.6691536
Enterprise	155 55 48.17	335 52 44.55	4.2960739
Nebo	173 36 57.38	353 34 48.08	4.7051448
Robinson	183 59 48.83	4 00 39.15	4.4999404
Redoak	287 04 00.84	107 09 02.70	4.1441831

ROBINSON, CHEROKEE NATION.

On high, flat-topped ridge in T. 10 N., 19 E., about 3 miles a little south of west from Starvilla. Theodolite elevated 20 feet.

Station mark: A stone post, 30 by 7 by 7 inches, set 28 inches in the ground, with copper bolt marked $\overset{\text{U. S.}}{\underset{\text{G. S.}}{+}}$ sunk in center of top.

[Latitude, 35° 21′ 14.51″. Longitude, 95° 17′ 22.45″.]

To station—	Azimuth.	Back azimuth.	Log. distance.
	° ′ ″	° ′ ″	*Meters.*
Tucker Knob	4 00 39.15	183 59 48.83	4.4999404
Enterprise	37 17 46.84	217 13 52.15	4.2292121
Checotah	110 35 09.18	290 25 39.72	4.4230683
Nebo	157 26 01.25	337 23 00.86	4.3101779
Choate	230 58 47.11	51 15 27.30	4.7461712
Cavanal	299 16 44.36	119 37 52.55	4.8054100
Redoak	342 40 55.60	162 45 08.23	4.5720205

NEBO, CHEROKEE NATION.

On highest part of flat ridge locally known as Nebo Mountain, about 12 miles northeast from Checotah and about 5 miles west of north from Burnett post-office. From corner common to secs. 10, 11, 14, and 15, T. 12 N., R. 18 E., station bears N. 60° 03′ E., 17.31 chains distant. Theodolite elevated 30 feet.

Station mark: A stone post, 24 by 7 by 7 inches, placed 8 inches in the ground, with copper bolt marked $\overset{\text{U. S.}}{\underset{\text{G. S.}}{+}}$ sunk in center.

[Latitude, 35° 31′ 26.45″. Longitude, 95° 22′ 33.56″.]

To station—	Azimuth.	Back azimuth.	Log. distance.
	° ′ ″	° ′ ″	*Meters.*
Enterprise	4 15 06.44	184 14 11.38	4.5110605
Checotah	60 34 14.95	240 27 44.88	4.2891939
Chimney	157 01 17.93	336 58 36.97	4.2507681
Grand	204 42 01.02	24 48 22.41	4.5940012
Choate	252 20 28.17	72 40 11.52	4.7296388
Cavanal	308 11 52.46	128 36 03.09	4.9081524
Robinson	337 23 00.86	157 26 01.25	4.3101779
Redoak	340 46 34.57	160 53 47.42	4.7611543
Tucker Knob	353 34 48.04	173 36 57.38	4.7051448

REDOAK, CHOCTAW NATION.

On highest point of flat-topped mountain known as Redoak Mountain, about 7 miles northwest from Redoak, a small town on Choctaw, Oklahoma and Gulf Railroad. From the corner common to secs. 2, 3, 34, and 35, on south boundary, T. 7 N., R. 20 E., station may be reached by going due north 21.10 chains, thence east 22.88 chains (to point 45 links east of center of station). Theodolite elevated 20 feet.

Station mark: Post-oak signal tree.

[Latitude, 35° 01′ 57.96″. Longitude, 95° 10′ 04.12″.]

To station—	Azimuth.	Back azimuth.	Log. distance.
	° ′ ″	° ′ ″	*Meters.*
Tucker Knob	107 09 02.70	287 04 00.84	4.1441831
Nebo	160 53 47.42	340 46 34.57	4.7611543
Robinson	162 45 08.23	342 40 55.60	4.5720205
Cavanal	264 27 03.81	84 43 55.20	4.6515599
Hartshorne	54 23 35.08	234 09 44.63	4.6567634
Dexter	25 22 22.06	205 13 54.57	4.7230759
Winding Stair	318 56 13.09	139 05 31.03	4.5768480

CHOATE, CHEROKEE NATION.

On highest point of high, flat-topped mountain about 3 miles west of Bunch, a very small town on Kansas City, Pittsburg and Gulf Railroad. From the corner common to secs. 19, 24, 25, and 30, T. 14 N., R. 23 E., station may be reached by going west 20.22 chains and north 9.30 chains. Theodolite elevated 42 feet.

Station mark: A stone post, 24 by 8 by 8 inches, placed 22 inches in the ground, with copper bolt marked $\overset{\text{U. S.}}{\underset{\text{G. S.}}{+}}$ sunk in center of top.

[Latitude, 35° 40′ 10.11″. Longitude, 94° 48′ 40.38″.]

To station—	Azimuth.	Back azimuth.	Log. distance.
	° ′ ″	° ′ ″	*Meters.*
Cavanal	349 40 23.73	169 45 00.14	4.8292412
Enterprise	48 04 44.53	227 44 10.22	4.8592724
Robinson	51 15 27.30	230 58 47.11	4.7461712
Nebo	72 40 11.52	252 20 28.17	4.7296388
Chimney	90 27 02.85	270 04 36.12	4.7640609
Grand	119 30 07.47	299 16 41.44	4.5995755
Spade	201 48 16.56	21 51 57.17	4.4062574

CAVANAL, CHOCTAW NATION.

On Cavanal Mountain, a well-known point about 4 miles west of Poteau, a town on Kansas City, Pittsburg and Gulf Railroad. The corner common to secs. 16, 17, 20, and 21, T. 7 N., R. 25 E., may be reached from station by going due west 11.49 chains to the north-south line, thence north 10.75 chains.

Station mark: Copper bolt set in sandstone rock.

[Latitude, 35° 04′ 15.08″. Longitude, 94° 40′ 43.06″.]

To station—	Azimuth.	Back azimuth.	Log. distance.
	° ′ ″	° ′ ″	*Meters.*
Redoak	84 43 55.20	264 27 03.81	4.6515599
Enterprise	105 24 47.52	284 59 47.36	4.8347026
Robinson	119 37 52.55	299 16 44.36	4.8054100
Nebo	128 36 03.09	308 11 52.46	4.9081524
Choate	169 45 00.14	349 40 23.73	4.8292416
Winding Stairs	31 26 09.15	211 18 39.19	4.5834269

GRAND, CHEROKEE NATION.

On high timbered ridge about 5 miles northeast from Fort Gibson, a town on St. Louis, Iron Mountain, and Southern Railway. The road from Fort Gibson to Melvin passes about 200 yards east of station. From the corner common to secs. 20, 21, 28, and 29, T. 16 N., R. 20 E., station may be reached by going north 0° 02′ W. 7 chains, thence N. 54° 33′ E. 17.50 chains. Theodolite elevated 40 feet.

Station mark: A stone post, 24 by 8 by 8 inches, with copper bolt marked $\overset{\text{U. S.}}{\underset{\text{G. S.}}{+}}$ sunk in center of top.

[Latitude, 35° 50′ 43.41″. Longitude, 95° 11′ 39.74″.]

To station—	Azimuth.	Back azimuth.	Log. distance.
	° ′ ″	° ′ ″	*Meters.*
Nebo	24 48 22.41	204 42 01.02	4.5940012
Chimney	50 35 12.03	230 26 08.37	4.4812237
Concharty	91 34 33.92	271 14 31.71	4.7120103
Barber	123 48 12.76	303 40 07.04	4.3974645
Merchant	141 48 40.13	321 38 24.35	4.6270376
Corbett	147 55 54.08	327 46 03.56	4.6743218
Salina	202 55 33.73	23 01 29.85	4.5895756
Spade	264 29 41.79	84 46 50.98	4.6460932
Choate	299 16 41.44	119 30 07.47	4.5995755

SPADE, CHEROKEE NATION.

On high timbered hill known as Spade Mountain, 7 or 8 miles northwest from Stillwell, a town on Kansas City, Pittsburg and Gulf Railroad. From the quarter corner on line between secs. 1 and 12, T. 16 N., R. 24 E., station may be reached by going S. 89° 39′ E. 11.63 chains, thence due south 12.62 chains. Theodolite elevated 20 feet. Highest trees were cut from the summit of the hill.

Station mark: A stone post, 24 by 8 by 8 inches, placed 22 inches in the ground, with copper bolt marked $\overset{\text{U. S.}}{\underset{\text{G. S.}}{+}}$ sunk in center.

[Latitude, 35° 52′ 57.64″. Longitude, 94° 42′ 23.01″.]

To station—	Azimuth.	Back azimuth.	Log. distance.
	° ′ ″	° ′ ″	*Meters.*
Choate	21 51 57.17	201 48 16.56	4.4062574
Grand	84 46 50.98	264 29 41.79	4.6460932
Salina	137 46 20.77	317 35 03.85	4.6314574
Kansas	165 54 43.46	345 50 55.29	4.5995950
Baptist	213 19 54.66	33 24 08.59	4.2945621

SALINA, CHEROKEE NATION.

On highest point of rolling timbered hills about 3½ miles southwest from Salina court-house. From point 32.95 chains north, on line between secs. 35 and 36, T. 20 N., R. 21 E., station may be reached by going due east 9.50 chains. Theodolite elevated 40 feet.

Station mark: A stone post, 24 by 7 by 7 inches placed 22 inches in the ground, with copper bolt marked $\overset{\text{U. S.}}{\underset{\text{G. S.}}{+}}$ sunk in center of top.

[Latitude, 36° 10′ 04.41″. Longitude, 95° 01′ 33.97″.]

To station—	Azimuth.	Back azimuth.	Log. distance.
	° ′ ″	° ′ ″	*Meters.*
Grand	23 01 29.85	202 55 33.73	4.5895755
Merchant	86 38 36.97	266 22 31.40	4.6170996
Corbett	96 06 44.50	275 50 54.04	4.6068569
Dog Creek	124 56 53.98	304 42 34.65	4.6449413
Spavinaw	168 36 29.33	348 34 55.09	4.3035865
Round Springs	207 39 50.86	27 44 59.35	4.4469067
Kansas	249 58 38.63	69 06 09.42	4.3072366
Spade	317 35 03.85	137 46 20.77	4.6314574

BARBER, CREEK NATION.

On a small prairie mountain 3 miles northwest of Wagoner. The corner common to secs. 7, 8, 17, and 18, T. 17 N., R. 18 E., may be reached from station by going S. 84° 30′ E., 14.56 chains to north-south line, thence south 60 chains.

Station mark: A rock marked $\overset{\text{U. S.}}{\underset{\text{G. S.}}{+}}$ sunk in ground flush with surface.

[Latitude, 35° 58′ 13.40″. Longitude, 95° 25′ 27.94″.]

To station—	Azimuth.	Back azimuth.	Log. distance.
	° ′ ″	° ′ ″	*Meters.*
Concharty	67 45 53.06	247 34 42.92	4.5210429
Merchant	164 11 49.69	344 09 40.46	4.3043975
Corbett	170 27 26.89	350 25 43.32	4.4231780
Grand	303 40 07.04	123 48 12.76	4.3974645

BAPTIST, CHEROKEE NATION.

On a lone hill known as Mission Mountain, about 1½ miles southwest from Baptist post-office, on Kansas City, Pittsburg and Gulf Railroad. All timber was cut from south end of hill with the exception of one tree, which was used for signal. From point 64.29 chains east on line between secs. 13 and 24, T. 18 N., R. 25 E., station may be reached by going due south 3.51 chains.

Station mark: Lone signal tree.

[Latitude, 36° 01′ 51.57″. Longitude, 94° 35′ 10.55″.]

To station—	Azimuth.	Back azimuth.	Log. distance.
	° ′ ″	° ′ ″	*Meters.*
Spade	33 24 08.59	213 19 54.66	4.2945621
Kansas	137 13 41.87	317 05 38.30	4.4794358
Decatur	201 09 43.12	21 14 22.39	4.5146056

DECATUR, BENTON COUNTY, ARKANSAS.

On a timbered hill on west side and about one-fourth mile distant from Kansas City, Pittsburg and Gulf Railroad, at point about 4 miles south from town of Decatur. Theodolite elevated 40 feet.

Station mark: A stone post, 24 by 7 by 7 inches, placed 22 inches in the ground, with copper bolt sunk in center of top.

[Latitude, 36° 18′ 20.83″. Longitude, 94° 27′ 17.33″.]

To station—	Azimuth.	Back azimuth.	Log. distance.
	° ′ ″	° ′ ″	*Meters.*
Baptist	21 14 22.39	201 09 43.12	4.5146056
Kansas	75 33 45.91	255 21 00.82	4.5231238
Round Spring	104 01 35.00	283 46 25.04	4.5959206

KANSAS, CHEROKEE NATION.

On highest point of flat timbered ridge about 2 miles northwest from Kansas post-office. A local road running northwest passes 100 yards west of station. From point 56.70 chains on line N. 0° 01′ W. between secs. 11 and 12, T. 20 N., R. 23 E., station may be reached by going due east 175 links. Theodolite elevated 40 feet.

Station mark: A stone post, 24 by 8 by 8 inches placed 22 inches in the ground, with copper bolt marked $\overset{\text{U. S.}}{\underset{\text{G. S.}}{\triangle}}$ sunk in center of top.

[Latitude, 36° 13′ 49.10″. Longitude, 94° 48′ 50.68″.]

To station—	Azimuth.	Back azimuth.	Log. distance.
	° ′ ″	° ′ ″	*Meters.*
Spade	345 50 55.29	165 54 43.46	4.5995950
Salina	69 06 09.42	249 58 38.63	4.3072366
Baptist	317 05 38.30	137 13 41.87	4.4794358
Decatur	255 21 00.82	75 33 45.91	4.5231238
Round Spring	161 20 08.78	341 17 45.50	4.2751402
Spavinaw	118 08 16.98	298 59 10.94	4.4206278

ROUND SPRING, CHEROKEE NATION.

On flat timbered ridge about 2 miles southeast from Round Spring, a well-known point on road between Spavinaw post-office and Southwest City, Missouri. From the corner common to secs. 7, 8, 17, and 18, T. 22 N., R. 23 E., station may be reached by going due south 943 feet, thence S. 48° 15′ W. 522 feet. Theodolite elevated 62 feet.

Station mark: A stone post, 24 by 7 by 7 inches placed 22 inches in the ground, with copper bolt sunk in center of top.

[Latitude, 36° 23′ 28.20″. Longitude, 94° 52′ 52.64″.]

To station—	Azimuth.	Back azimuth.	Log. distance.
	° ′ ″	° ′ ″	*Meters.*
Spavinaw	73 28 10.32	253 21 26.69	4.2481093
Harman	148 48 33.99	328 43 51.88	4.3576162
Decatur	283 46 25.04	104 01 35.00	4.5959206
Kansas	341 17 45.50	161 20 08.78	4.2751402
Whitewater	240 33 44.43	60 40 36.41	4.2972881
Salina	27 44 59.35	207 39 50.86	4.4469067

SPAVINAW, CHEROKEE NATION.

On highest point of rolling timbered hills, about 4 miles south from Spavinaw post-office. Road from Salina to Spavinaw passes about three-fourths of a mile west from station at point 4 miles from latter. From point 70 chains on line 0° 02′ W. between secs. 32 and 33, T. 22 N., R. 21 E., station may be reached by going S. 63° E. 33.98 chains. Theodolite elevated 36 feet.

Station mark: A stone post, 24 by 7 by 7 inches, placed 22 inches in the ground, with copper bolt sunk in center of top.

[Latitude, 36° 20′ 44.23″. Longitude, 95° 04′ 13.32″.]

To station—	Azimuth.	Back azimuth.	Log. distance.
	° ′ ″	° ′ ″	*Meters.*
Salina	348 34 55.09	168 36 29.33	4.3035865
Dog Creek	99 46 58.33	279 34 11.68	4.5144608
Wills	141 23 35.83	321 15 04.38	4.5350913
Harman	191 48 02.75	11 50 05.26	4.3991109
Round Spring	253 21 26.69	73 28 10.32	4.2481093
Kansas	298 59 10.94	118 08 16.98	4.4206278
Corbett	66 55 52.51	246 41 34.31	4.5953074

CORBETT, CHEROKEE NATION.

On high prairie hill about 8 miles west from Choteau, a town on Missouri, Kansas, and Texas Railway. The corner common to secs. 14, 15, 22, and 23, T. 20 N., R. 17 E., may be reached from station by going N. 72° 46′ W. 7.08 chains.

Station mark: A stone, post 25 by 7 by 7 inches, placed 22 inches in the ground, with copper bolt marked $\overset{\text{U. S.}}{\underset{\text{G. S.}}{\triangle}}$ sunk in center of top.

[Latitude, 36° 12′ 21.12″. Longitude, 95° 28′ 23.78″.]

To station—	Azimuth.	Back azimuth.	Log. distance.
	° ′ ″	° ′ ″	*Meters.*
Salina	275 50 54.04	96 06 44.50	4.6068569
Grand	327 46 03.56	147 55 54.08	4.6743218
Spavinaw	246 41 34.31	66 55 52.51	4.5953074
Dog Creek	190 35 36.48	10 37 09.80	4.3297503
McGinnis	121 10 15.32	301 01 44.48	4.4010233
Merchant	9 13 03.50	189 12 37.68	3.8340395
Barber	350 25 43.32	170 27 26.89	4.4231780
Weer	62 04 38.55	241 53 34.36	4.5037586

DOG CREEK, CHEROKEE NATION.

On highest point of timbered ridge at the head of Dog Creek, about 8 miles northwest from Pryor Creek, a town on Missouri, Kansas and Texas Railway. Road from Pryor Creek to Chelsea passes east of and near station. From line east between secs. 7 and 18, T. 22 N., R. 18 E., at 24.56 chains, station bears N. 13° 16′ W., 4.15 chains distant. Theodolite elevated 40 feet.

Station mark: A stone post, 25 by 8 by 8 inches, set 23 inches in the ground, with copper bolt marked $\genfrac{}{}{0pt}{}{\text{U. S.}}{\text{G. S.}}$ sunk in center of top.

[Latitude, 36° 23′ 42.51″. Longitude, 95° 25′ 46.15″.]

To station—	Azimuth.	Back azimuth.	Log. distance.
	° ′ ″	° ′ ″	*Meters.*
Salina	304 42 34.65	124 56 53.98	4.6449413
Corbett	10 37 09.80	190 35 36.48	4.3297503
Harman	242 50 31.73	63 05 22.97	4.6221325
Wills	206 47 55.03	26 52 12.12	4.3772365
Spavinaw	279 34 11.68	99 46 58.33	4.5144608
Nowata	141 40 22.52	321 30 13.09	4.6125788
McGinnis	72 38 51.29	252 28 45.35	4.4263426
Weer	41 48 22.82	221 35 43.95	4.6830193

WILLS, CHEROKEE NATION.

On highest point of timbered ridge about 4 miles northeast from Catale, a post-office on St. Louis and San Francisco Railroad, and about 3 miles southwest from Mr. Grayson Wills's residence. Railroad passes very near station. Station is 21.10 chains north of corner between secs. 5 and 6, T. 24 N., R. 19 E. Theodolite elevated 36 feet.

Station mark: A stone post, 24 by 8 by 8 inches, placed 22 inches in the ground, with copper bolt marked U. S. G. S. sunk in center of top.

[Latitude, 36° 35′ 12.54″. Longitude, 95° 18′ 33.85″.]

To station—	Azimuth.	Back azimuth.	Log. distance.
	° ′ ″	° ′ ″	*Meters.*
Spavinaw	321 15 04.38	141 23 35.83	4.5350913
Dog Creek	26 52 12.12	206 47 55.03	4.3772365
Harman	274 42 53.41	94 53 29.06	4.4251143
Bluejacket	216 05 24.85	36 12 06.89	4.4521138
Blue Mound	164 46 10.76	344 43 37.05	4.3851818
Nowata	106 48 23.19	286 33 54.42	4.5770317

HARMAN, CHEROKEE NATION.

On prairie end of a timbered ridge about 10 miles southeast of Vinita. Road from Vinita to Southwest City, Missouri, passes near station at point 10 miles from former. From the corner common to secs. 7, 12, 13, and 18, T. 24 N., R. 21 E., station may be reached by going west between secs. 12 and 13 28.85 chains, thence S. 44° W. 13.25 chains. Theodolite elevated 15 feet.

Station mark: A stone post, 24 by 8 by 8 inches, placed 22 inches in the ground, with copper bolt marked U. S. G. S. sunk in center of top.

[Latitude, 36° 34′ 00.25″. Longitude, 95° 00′ 47.15″.]

To station—	Azimuth.	Back azimuth.	Log. distance.
	° ′ ″	° ′ ″	*Meters.*
Spavinaw	11 50 05.26	191 48 02.75	4.3991109
Wills	94 53 29.06	274 42 53.41	4.4251143
Round Spring	328 43 51.88	148 48 33.99	4.3576162
Seneca	243 16 13.46	63 28 22.72	4.5310247
Potato Hill	186 23 44.04	6 25 17.68	4.5418089
Bluejacket	158 44 49.93	338 40 54.68	4.4303314
Whitewater	288 27 17.83	108 38 53.07	4.4865362
Wasson	166 02 37.50	345 58 31.23	4.6256566

WHITEWATER, CHEROKEE NATION.

On flat timbered ridge on south side and 1 mile distant from Whitewater Creek at point 4 miles west from Arkansas line. Road from Spavinaw to Southwest City, Missouri, passes 1 mile south from station at point 6 or 7 miles from latter. From the corner common to secs. 7, 12, 13, and 18, T. 23 N., R. 24 E., station bears S. 56° 02′ W., 31.42 chains distant. Theodolite elevated 40 feet.

Station mark: A stone post, 24 by 7 by 7 inches, placed 22 inches in the ground, with copper bolt marked $\frac{\text{U. S.}}{\text{G. S.}}$ sunk in center of top.

[Latitude, 36° 28′ 43.81″. Longitude, 94° 41′ 18.96″.]

To station—	Azimuth.	Back azimuth.	Log. distance.
	° ′ ″	° ′ ″	Meters.
Round Spring............	60 40 36.41	240 33 44.43	4.2972881
Harman..................	108 38 53.07	288 27 17.83	4.4865362
Seneca..................	183 04 02.77	3 04 34.91	4.3981625

SENECA, SENECA NATION.

On highest point of rolling timbered hills in T. 26 N., R. 24 E., about 6 miles northwest from Tiff City, Missouri. Road from Grove to Seneca, Missouri, passes east from station at point 10 or 11 miles from Seneca. Theodolite elevated 40 feet.

Station mark: A stone post, 24 by 7 by 7 inches, placed 22 inches in the ground, with copper bolt marked $\frac{\text{U. S.}}{\text{G. S.}}$ sunk in center of top.

[Latitude, 36° 42′ 14.11″. Longitude, 94° 40′ 25.03″.]

To station—	Azimuth.	Back azimuth.	Log. distance.
	° ′ ″	° ′ ″	Meters.
Whitewater..............	3 04 34.91	183 04 02.77	4.3981625
Harman..................	63 28 22.72	243 16 13.46	4.5310247
Bluejacket..............	103 58 24.72	283 42 17.89	4.6157967
Wasson..................	122 35 52.45	302 19 33.36	4.6811412
Potato Hill.............	126 20 57.25	306 10 19.12	4.5153808
Edwards.................	158 12 15.96	338 06 52.76	4.5548967
Peoria..................	190 41 33.33	10 43 14.93	4.3546688

PEORIA, PEORIA NATION (not occupied).

On a flat timbered ridge in T. 28 N., R. 25 E., 1 mile west from Missouri line, at point 6 miles north from Seneca, Missouri.

Station mark: A stone post, 25 by 7 by 7 inches, placed 22 inches in the ground, with copper bolt marked $\genfrac{}{}{0pt}{}{\text{U. S.}}{\text{G. S.}}$ sunk in center of top.

[Latitude, 36° 54′ 15.44″. Longitude, 94° 37′ 35.44″.]

To station—	Azimuth.	Back azimuth.	Log. distance.
	° ′ ″	° ′ ″	*Meters.*
Seneca	10 43 14.93	190 41 33.33	4.3546688
Edwards	122 20 26.60	302 13 20.69	4.3166521

POTATO HILL, CHEROKEE NATION.

On prairie, at a point locally known as Potato Hill. Road from Bluejacket to Miami passes southeast and very near station, at point 10 or 11 miles from former. From line east between secs. 29 and 32, T. 28 N., R. 22 E., at 48.26 chains from corner, station bears due north, 24.35 chains distant.

Station mark: A rock monument 6 feet high and 5 or 6 feet in diameter at base.

[Latitude, 36° 52′ 42.74″. Longitude, 94° 58′ 10.54″.]

To station—	Azimuth.	Back azimuth.	Log. distance.
	° ′ ″	° ′ ″	*Meters.*
Seneca	306 10 19.12	126 20 57.25	4.5153808
Harman	6 25 17.68	186 23 44.04	4.5418089
Edwards	223 02 51.73	43 08 08.24	4.2804780
Wasson	114 26 36.83	294 20 55.61	4.1888109
Bluejacket	55 10 50.11	235 05 20.12	4.2207046

WASSON, CHEROKEE NATION.

On high prairie ridge about 3 miles west from Wasson, a switch on Missouri, Kansas and Texas Railway. From line N. 0° 1′ W. between secs. 1 and 2, T. 28 N., R. 20 E., at 20.73 chains, station bears due west, 11.70 chains distant.

Station mark: A stone post, 25 by 7 by 7 inches, placed 22 inches in the ground, with copper bolt marked $\genfrac{}{}{0pt}{}{\text{U. S.}}{\text{G. S.}}$ sunk in center of top.

[Latitude, 36° 56′ 09.70″. Longitude, 95° 07′ 38.75″.]

To station—	Azimuth.	Back azimuth.	Log. distance.
	° ′ ″	° ′ ″	Meters.
Edwards	254 19 49.12	74 30 47.56	4.4489361
Potato Hill	294 20 55.61	114 26 36.83	4.1888109
Bluejacket	358 24 33.48	178 24 44.15	4.2010781
Harman	345 58 31.23	166 02 37.50	4.6256566
Seneca	302 19 33.36	122 35 52.45	4.6811412

EDWARDS, CHEROKEE COUNTY, KANSAS.

On a prairie hill, locally known as Blue Mound, one-fourth mile north from line between Kansas and Quapaw Nation, Indian Territory, at point about 6 miles west of Baxter Springs, Kansas. Land is owned by Mr. Edwards.

Station mark: A stone post, 24 by 7 by 7 inches, placed 22 inches in the ground, with copper bolt sunk in center of top.

[Latitude, 37° 00′ 14.64″. Longitude, 94° 49′ 23.90″.

To station—	Azimuth.	Back azimuth.	Log. distance.
	° ′ ″	° ′ ″	Meters.
Peoria	302 13 20.69	122 20 26.60	4.3166521
Seneca	338 06 52.76	158 12 15.96	4.5548967
Potato Hill	43 08 08.24	223 02 51.73	4.2804780
Bluejacket	48 47 01.38	228 36 14.68	4.5502216
Wasson	74 30 47.56	254 19 49.12	4.4489361

BLUEJACKET, CHEROKEE NATION.

On highest point of flat-topped timbered mountain or hill, locally known as Bluejacket Mountain. Hill is about 3 miles a little south of west from Bluejacket, a town on the Missouri, Kansas and Texas Railway. From line north between secs. 25 and 26, T. 27 N., R. 20 E., at 53.50 chains, station bears S. 25° 20′ E., 23.45 chains distant. Theodolite elevated 55 feet.

Station mark: A stone post, 25 by 8 by 8 inches, placed 22 inches in the ground, with copper bolt marked $\overset{\text{U. S.}}{\underset{\text{G. S.}}{+}}$ sunk in center of top.

[Latitude, 36° 47′ 34.48″. Longitude, 95° 07′ 20.96″.]

To station—	Azimuth.	Back azimuth.	Log. distance.
	° ′ ″	° ′ ″	*Meters.*
Wasson	178 24 44.15	358 24 33.48	4.2010781
Potato Hill	235 05 20.12	55 10 50.11	4.2207046
Wills	36 12 06.89	216 05 24.85	4.4521138
Blue Mound	91 26 48.76	271 17 31.65	4.3629821
Harman	338 40 54.68	158 44 49.93	4.4303314
Edwards	228 36 14.68	48 47 01.38	4.5502216
Seneca	283 42 17.89	103 58 24.72	4.6157967

BLUE MOUND, CHEROKEE NATION.

On the highest of several prairie hills, about 3 miles southwest from Miles post-office. The hill is locally known as Blue Mound. From corner common to secs. 21, 22, 27, and 28, T. 27 N., R. 18 E., station bears S. 47° W., and from corner common to secs. 20, 21, 28, and 29 station bears S. 74° 55′ E.

Station mark: A tree wired up.

[Latitude, 36° 47′ 52.36″. Longitude, 95° 22′ 51.09″.]

To station—	Azimuth.	Back azimuth.	Log. distance.
	° ′ ″	° ′ ″	*Meters.*
Bluejacket	271 17 31.65	91 26 48.76	4.3629821
Wills	344 43 37.05	164 46 10.76	4.3851818
Nowata	67 10 16.62	246 58 19.58	4.5090643
California	89 41 31.72	269 27 52.70	4.5302085
Timber Hill	117 20 59.76	297 08 25.37	4.5444066

TIMBER HILL, CHEROKEE NATION.

On timber-covered hill locally known as Timber Hill. Road from Barnesville to Coffeyville, Kansas, passes west and very near signal at point 9 miles from latter. From the corner of Ts. 27 and 28 N., Rs. 14 and 15 E., station may be reached by running east on seventh standard parallel 7.42 chains, thence south 32 links. Theodolite elevated 35 feet.

Station mark: A stone post, 24 by 8 by 8 inches, placed 21 inches in the ground, with copper bolt marked $\overset{\text{U. S.}}{\underset{\text{G. S.}}{+}}$ sunk in center of top.

[Latitude, 36° 56′ 32.56″. Longitude, 95° 43′ 48.40″.]

To station—	Azimuth.	Back azimuth.	Log. distance.
	° ′ ″	° ′ ″	Meters.
Blue Mound	297 08 25.37	117 20 59.76	4.5444066
Nowata	357 05 14.19	177 05 49.33	4.4571525
Panther	40 50 41.73	220 39 58.27	4.6105159
Caney	99 55 15.52	279 45 49.47	4.3736097
California	9 30 46.14	189 29 40.11	4.2177888

CALIFORNIA, CHEROKEE NATION.

On a high and rather flat prairie ridge, about 10 miles northwest of Nowata, a town on the St. Louis, Iron Mountain and Southern Railway. The corner common to secs. 25, 26, 35, and 36, T. 27 N., R. 14 E., may be reached from station by going S. 16° 03′ W. 52.78 chains to east and west line, thence west 40.015 chains.

Station mark: A stone post, 24 by 8 by 8 inches, placed 22 inches in the ground, with a copper bolt marked U. S. G. S. sunk in center of top.

[Latitude, 36° 47′ 44.27″. Longitude, 95° 45′ 38.47″.]

To station—	Azimuth.	Back azimuth.	Log. distance.
	° ′ ″	° ′ ″	Meters.
Panther	58 39 48.52	238 30 11.99	4.4476258
Caney	134 42 12.40	314 33 53.38	4.4613481
Timber Hill	189 29 40.11	9 30 46.14	4.2177888
Nowata	341 14 06.14	161 15 47.06	4.1146470
Blue Mound	269 27 52.70	89 41 31.72	4.5302085

NOWATA, CHEROKEE NATION.

On high and rather flat prairie ridge, about 4 miles a little south of west of Nowata. Road from Nowata to Ringo passes 2 miles southeast of station at point 5 miles from former. From quarter corner between secs. 4 and 33, Ts. 25 and 26 N., R. 15 E., station bears west, 16.89 chains distant.

Station mark: A stone post, 24 by 7 by 7 inches, placed 22 inches in the ground, with copper bolt marked U. S. G. S. sunk in center of top.

[Latitude, 36° 41′ 04.27″. Longitude, 95° 42′ 49.76″.]

To station—	Azimuth.	Back azimuth.	Log. distance.
	° ′ ″	° ′ ″	*Meters.*
Blue Mound	246 58 19.58	67 10 16.62	4.5090643
Wills	286 33 54.42	106 48 23.19	4.5770317
Timber Hill	177 05 49.33	357 05 14.19	4.4571525
Panther	85 27 27.81	265 16 11.27	4.4505532
Skiatook	49 03 24.72	228 50 58.50	4.6160005
McGinnis	359 55 04.31	179 55 05.68	4.6032387
California	161 15 47.06	341 14 06.14	4.1146470
Dog Creek	321 30 13.09	141 40 22.52	4.6125788

M'GINNIS, CHEROKEE NATION.

In T. 21 N., R. 15 E., on highest point of a high ridge with scattering timber on it. This ridge extends along the west side of the Verdigris River, about 7 miles west from Claremore, a town on the St. Louis and San Francisco Railroad. Road from Claremore to Eli passes south of and 1 mile from the station. Theodolite elevated 34 feet.

Station mark: A stone post, 24 by 7 by 7 inches, placed 22 inches in the ground, with copper bolt marked $\genfrac{}{}{0pt}{}{\text{U. S.}}{\text{G. S.}}$ sunk in center of top.

[Latitude, 36° 19′ 23.05″. Longitude, 95° 42′ 47.45″.]

To station—	Azimuth.	Back azimuth.	Log. distance.
	° ′ ″	° ′ ″	*Meters.*
Skiatook	112 38 48.35	292 26 23.94	4.5297992
Nowata	179 55 05.68	359 55 04.31	4.6032387
Weer	13 12 56.02	193 10 20.92	4.4585858
Tulsa	67 00 44.14	246 48 50.98	4.5147481
Panther	143 20 26.02	323 09 10.98	4.6740564
Merchant	313 53 07.78	134 01 12.44	4.4539608
Corbett	301 01 44.48	121 10 15.32	4.4010233
Dog Creek	252 28 45.85	72 38 51.29	4.4263426

TULSA, OSAGE NATION, OKLAHOMA TERRITORY.

On a very prominent prairie peak, about 5 miles northwest of Tulsa, a town on the St. Louis and San Francisco Railroad. Road from Tulsa to Cleveland, Arkansas, passes very near station. The corner common to secs. 7, 8, 17, and 18, T. 20 N., R. 12 E., may be reached from station by going due west 29.39 chains to north-south line, thence north 50.61 chains.

Station mark: A stone post, 24 by 7 by 7 inches, placed 22 inches in the ground, with copper bolt sunk in center of top.

[Latitude, 36° 12′ 26.84″. Longitude, 96° 02′ 53.08″.]

To station—	Azimuth.	Back azimuth.	Log. distance.
	° ′ ″	° ′ ″	*Meters.*
Skiatook	177 16 22.22	357 15 52.98	4.4123352
McGinnis	246 48 50.98	67 00 44.14	4.5147481
Weer	302 39 44.40	122 49 00.53	4.4476239
Prairie	357 27 52.19	177 28 19.97	4.4267742

SKIATOOK, OSAGE NATION, OKLAHOMA TERRITORY.

On a small knoll on highest part of timbered ridge about 6 miles northwest from Skiatook, a post-office in the Cherokee Nation, Indian Territory. Road between Skiatook and Pawhuska passes about 300 yards north of station at point 6 miles from latter. The corner common to secs. 29, 30, 31, and 32, T. 23 N., R. 12 E., may be reached from station by going due east 60.56 chains to north-south line, thence south 32.79 chains. Theodolite elevated 40 feet.

Station mark: A stone post, 24 by 8 by 8 inches, placed 22 inches in the ground, with copper bolt marked $\frac{\text{U. S.}}{\text{G. S.}}$ sunk in center of top.

[Latitude, 36° 26′ 24.31″. Longitude, 96° 03′ 42.45″.]

To station—	Azimuth.	Back azimuth.	Log. distance.
	° ′ ″	° ′ ″	*Meters.*
Panther	186 50 15.58	6 51 27.02	4.3983118
Nowata	228 50 58.50	49 03 24.72	4.6160005
McGinnis	292 26 23.94	112 38 48.35	4.5297992
Tulsa	357 15 52.98	177 16 22.22	4.4123352
Monument	56 03 35.76	235 53 56.03	4.4684714
Tres Mounds	100 50 57.57	280 41 10.74	4.3984362
Pawhuska	146 13 44.48	326 06 03.07	4.5388769

PANTHER, OSAGE NATION, OKLAHOMA TERRITORY.

On highest part of ridge, with scattering timber on it, at the head of Panther Creek. Road between Bartlesville and Hominy, Indian Territory, passes 100 yards north of station at point about 8 miles from former. The corner common to secs. 4, 5, 8, and 9, T. 25 N.,

R. 12 E., may be reached by going due east 17.23 chains to north-south line, thence north 9.85 chains. Theodolite elevated 40 feet.

Station mark: A stone post, 24 by 7 by 7 inches, placed 22 inches in the ground, with copper bolt marked U. S. G. S. sunk in center of top.

[Latitude, 36° 39′ 50.27″. Longitude, 96° 01′ 42.50″.]

To station—	Azimuth.	Back azimuth.	Log. distance.
	° ′ ″	° ′ ″	*Meters.*
Timber Hill	220 39 58.27	40 50 41.73	4.6105159
Nowata	265 16 11.27	85 27 27.81	4.4505532
Skiatook	6 51 27.02	186 50 15.58	4.3983118
California	238 30 11.99	58 39 48.52	4.4476258
McGinnis	323 09 10.98	143 20 26.02	4.6740564
Pawhuska	99 59 43.44	279 50 49.16	4.3530341
Spring Creek	139 35 51.39	319 27 51.99	4.4857711

CANEY, CHEROKEE NATION.

On highest point of prairie ridge about 3¼ miles southwest of Caney, Kansas. Road between Caney and Pawhuska, Oklahoma Territory, passes about 200 yards east of station at point 3¼ miles from former. The corner common to secs. 22, 23, 26, and 27, T. 29 N., R. 12 E., may be reached from station by going S. 86° 30′ E. 32.88 chains to north-south line, thence south 40 chains.

Station mark: A rock about 4 feet square, with a copper bolt marked U. S. G. S. sunk into it.

[Latitude, 36° 58′ 43.64″. Longitude, 95° 59′ 29.83″.]

To station—	Azimuth.	Back azimuth.	Log. distance.
	° ′ ″	° ′ ″	*Meters.*
Timber Hill	279 45 49.47	99 55 15.52	4.3736097
Panther	5 23 15.45	185 21 55.94	4.5451946
California	314 33 53.38	134 42 12.40	4.4613481
Spring Creek	63 18 40.66	243 09 19.79	4.4129408
Artillery	88 46 57.15	268 38 08.64	4.3372276

ARTILLERY, OSAGE NATION, OKLAHOMA TERRITORY.

On highest part of hill locally known as Artillery Mountain, about 3½ miles southeast from Elgin, Kansas.

Station mark: A stone post, 24 by 7 by 7 inches, placed 22 inches in the ground, with copper bolt marked U. S. G. S. sunk in center of top.

[Latitude, 36° 58′ 27.75″. Longitude, 96° 14′ 08.50″.]

To station—	Azimuth.	Back azimuth.	Log. distance.
	° ′ ″	° ′ ″	*Meters.*
Caney	268 38 08.64	88 46 57.15	4.3372276
Spring Creek	6 56 31.64	186 55 58.67	4.0510469

SPRING CREEK, OSAGE NATION, OKLAHOMA TERRITORY.

On the highest part of a flat, timbered ridge (no timber within 100 yards of station). Road between Elgin, Kansas, and Pawhuska, Oklahoma Territory, passes about 1 mile west from station at a point 12 miles from former. Theodolite elevated 20 feet.

Station mark: A stone post, 24 by 7 by 7 inches, placed 22 inches in the ground, with copper bolt marked $\frac{\text{U. S.}}{\text{G. S.}}$ sunk in center of top.

[Latitude, 36° 52′ 25.56″. Longitude, 96° 15′ 03.39″.]

To station—	Azimuth.	Back azimuth.	Log. distance.
	° ′ ″	° ′ ″	*Meters.*
Artillery	186 55 58.67	6 56 31.64	4.0510469
Caney	243 09 19.79	63 18 40.66	4.4129408
Panther	319 27 51.99	139 35 51.39	4.4857711
Pawhuska	6 49 26.30	186 48 30.30	4.2908297
Flint	60 31 16.82	240 20 22.61	4.4930920

PAWHUSKA, OSAGE NATION, OKLAHOMA TERRITORY.

On high prairie hill about 4 miles a little north of east from Pawhuska, Oklahoma Territory. Road from Pawhuska, Oklahoma Territory, to Bartleville, Indian Territory, passes the foot of mountain on south side.

Station mark: A stone post, 25 by 8 by 8 inches, placed 22 inches in the ground, with copper bolt marked $\frac{\text{U. S.}}{\text{G. S.}}$ sunk in center of top.

[Latitude, 36° 41′ 56.28″. Longitude, 96° 16′ 36.90″.]

To station—	Azimuth.	Back azimuth.	Log. distance.
	° ′ ″	° ′ ″	*Meters.*
Spring Creek	186 48 30.30	6 49 36.30	4.2908297
Panther	279 50 49.16	99 59 43.44	4.3530341
Skiatook	326 06 03.07	146 13 44.48	4.5388769
Tres Mounds	12 26 06.12	192 23 59.13	4.3914142
Flint	99 20 22.52	279 10 25.56	4.3997971

FLINT, OSAGE NATION, OKLAHOMA TERRITORY.

On highest point on long range of prairie hills locally known as the Flint Hills. Road running west from Pawhuska into the Kaw Reservation passes about 1 mile south from station at point where it crosses the Flint Hills (about 14 miles from Pawhuska).

Station mark: A stone post, 25 by 7 by 7 inches, placed 22 inches in the ground, with copper bolt marked $\frac{\text{U. S.}}{\text{G. S.}}$ sunk in center of top.

[Latitude, 36° 44′ 07.30″. Longitude, 96° 33′ 15.40″.]

To station—	Azimuth.	Back azimuth.	Log. distance.
	° ′ ″	° ′ ″	*Meters.*
Spring Creek	240 20 22.61	60 31 16.82	4.4930920
Pawhuska	279 10 25.56	99 20 22.52	4.3997971
Tres Mounds............	325 08 17.04	145 16 05.45	4.5341085

TRES MOUNDS, OSAGE NATION, OKLAHOMA TERRITORY.

On the highest of three lone prairie hills locally known as Tres Mounds, about 3 miles north from Hominy post-office.

Station mark: A rock about 18 inches long, with $\frac{\text{U. S.}}{\text{G. S.}}$ cut on it. Rock about 2 inches above ground.

[Latitude, 36° 28′ 56.02″. Longitude, 96° 20′ 09.93″.]

To station—	Azimuth.	Back azimuth.	Log. distance.
	° ′ ″	° ′ ″	*Meters.*
Flint....................	145 16 05.45	325 08 17.04	4.5341085
Pawhuska	192 23 59.13	12 26 06.12	4.3914142
Skiatook	280 41 10.74	100 50 57.57	4.3984362
Monument	359 20 24.17	179 20 29.95	4.3249252

MONUMENT, OSAGE NATION, OKLAHOMA TERRITORY.

On a prairie hill 10 miles south of Hominy post-office. Road between Hominy and Tulsa, Indian Territory, goes within 1 mile of hill at point about 9 miles from Hominy, and then bears southeast. A "dim right hand" at this point passes near and east of the foot of the hill.

Station mark: A rock monument 7 feet high.

[Latitude, 36° 17′ 30.50″. Longitude, 96° 20′ 00.18″.]

To station—	Azimuth.	Back azimuth.	Log. distance.
	° ′ ″	° ′ ″	*Meters.*
Tres Mounds............	179 20 29.95	359 20 24.17	4.3249252
Skiatook	235 53 56.03	56 03 35.76	4.4684714

STILWELL, CHEROKEE NATION (not occupied).

On a high, timbered peak about 6 miles south from Stilwell. A higher, flat-topped, timbered mountain lies northeast from peak. From point 26.94 chains north from corner common to secs. 26, 27, 34, and 35, T. 15 N., R. 25 E., station bears east 9.01 chains distant.

Station mark: Lone signal tree.

[Latitude, 35° 44′ 41.06″. Longitude, 94° 37′ 39.08″.]

To station—	Azimuth.	Back azimuth.	Log. distance.
	° ′ ″	° ′ ″	*Meters.*
Choate	63 22 56.29	243 16 30.33	4.2695959
Spade	155 02 57.29	335 00 11.15	4.2274522
Baptist	186 40 45.43	6 42 08.85	4.5048461

SALLISAW, CHEROKEE NATION.

On highest point on timbered ridge about 4 miles south from town of Sallisaw, on Kansas City, Pittsburg and Gulf Railroad and St. Louis, Iron Mountain and Southern Railway, about 2½ miles northeast from Brent post-office. The corner common to secs. 21, 22, 27, and 28, T. 11 N., R. 24 E., may be reached from station by going due north 3.23 chains to east-west line between secs. 21 and 28, thence east 38.43 chains. Theodolite elevated 34 feet.

Station mark: A stone post, 24 by 8 by 8 inches, placed 22 inches in the ground, with copper bolt marked $\frac{\text{U. S.}}{\text{G. S.}}$ sunk in center of top.

[Latitude, 35° 24′ 18.13″. Longitude, 94° 46′ 08.22″.]

To station—	Azimuth.	Back azimuth.	Log. distance.
	° ′ ″	° ′ ″	*Meters.*
Nebo	103 38 51.05	283 17 43.13	4.7532830
Choate	172 33 17.87	352 31 10.02	4.4710443
Redoak	41 26 25.25	221 12 37.16	4.7403246

WINDING STAIR, CHOCTAW NATION.

On the highest point of the Winding Stair Mountains, locally well known by the above name, reached from Talihina, a town on the main line of the St. Louis and San Francisco Railroad. The corner to secs. 32 and 33, T. 4 N., R. 23 E., may be reached from station by going due west 22.15 chains to north-south line, thence south 44.24 chains.

Station mark: Stump of tree 3½ feet high, with rocks piled around it.

[Latitude, 34° 46′ 33.37″. Longitude, 94° 53′ 49.05″.]

To station—	Azimuth.	Back azimuth.	Log. distance.
	° ′ ″	° ′ ″	*Meters.*
Dexter	68 01 12.78	247 43 32.00	4.7094046
Redoak	139 05 31.03	318 56 13.09	4.5768480
Cavanal	211 18 39.19	31 26 09.15	4.5834269
Poteau	245 59 43.58	66 13 40.12	4.6093287
Polecat	297 08 53.13	117 23 45.61	4.6524261
Kiamichi	334 39 24.31	154 42 19.59	4.2630071

DEXTER, CHOCTAW NATION.

About 4 miles a little north of west from Dexter post-office, on the St. Louis and San Francisco Railroad. The quarter corner between secs. 28 and 23, T. 2 N., R. 18 E., is 2,473 feet north and 938 feet west of station. Theodolite elevated on a stump cut off 18 feet above ground.

Station mark: Signal tree.

[Latitude, 34° 36′ 07.32″. Longitude, 95° 24′ 52.95″.]

To station—	Azimuth.	Back azimuth.	Log. distance.
	° ′ ″	° ′ ″	*Meters.*
Hewitt	92 08 49.08	271 58 10.85	4.4571430
Hartshorne	146 08 49.37	326 03 29.37	4.4091583
Redoak	205 13 54.57	25 22 22.06	4.7230759
Winding Stair	247 43 32.00	68 01 12.78	4.7094046
Kiamichi	267 00 22.13	87 20 55.81	4.7434931
Thunderbolt	310 37 44.32	130 50 35.53	4.6618115
Kosoma	40 10 38.45	220 03 43.28	4.4626567

KIAMICHI, CHOCTAW NATION.

On highest point on ridge locally known as the Kiamichi Mountains. The Talihina and Mena (Arkansas) road passes 5 or 6 miles north of station at point 22 miles from Talihina (George Field's residence).

From Mr. Field's a trail to Smithville crosses mountains at point 3½ or 4 miles east from station. Fair traveling on horseback from this point up ridge to station. From point 23.15 chains north on line between secs. 19 and 20, T. 2 N., R. 24 E., station bears S. 76° E. 14.77 chains distant.

Station mark: A rock set in ground with U. S. G. S. cut in it.

[Latitude, 34° 37′ 35.85″. Longitude, 94° 48′ 42.15″.]

To station—	Azimuth.	Back azimuth.	Log. distance.
	° ′ ″	° ′ ″	Meters.
Dexter	87 20 55.81	267 00 22.13	4.7434931
Winding Stair	154 42 19.59	334 39 24.31	4.2630071
Polecat	277 02 01.42	97 13 57.35	4.5101014
Hardscrabble	330 09 55.23	150 18 45.73	4.6834888
Thunderbolt	32 20 44.63	212 13 06.61	4.5872205

POLECAT, CHOCTAW NATION.

On the highest part of point locally known as Polecat Peak. The Talihina and Mena road passes about 4 miles north of the station at point where road crosses the boundary line between Arkansas and the Indian Territory. Mr. Jack Conley's residence is near this point on the Arkansas side. A trail leads from his place to the station. Station is 21.53 chains south and 13.77 chains east of corner to secs. 3, 4, 33, and 34, Ts. 1 and 2 N., R. 27 E.

Station mark: An oak tree with U. S. G. S. cut on it. All other trees cut from summit of hill.

[Latitude, 34° 35′ 25.42″. Longitude, 94° 27′ 40.63″.]

To station—	Azimuth.	Back azimuth.	Log. distance.
	° ′ ″	° ′ ″	Meters.
Hardscrabble	12 17 35.04	192 14 32.78	4.5882821
Thunderbolt	61 40 42.89	241 21 11.80	4.7788619
Kiamichi	97 13 57.35	277 02 01.42	4.5101014
Winding Stair	117 23 45.61	297 08 53.13	4.6524261

BASE LINE, CHOCTAW NATION (not occupied).

On a narrow rock ridge in southwest corner of sec. 31, T. 1 N., R. 24 E. To reach station take road running northwest from Smithville post-office until standard parallel is crossed, thence west up ridge till station is reached. From point 17.15 chains north, between secs. 31 and 36, on range line Rs. 23 and 24 E., T. 1 N., station may be reached by going east 7.61 chains.

Station mark: White oak signal tree.

[Latitude, 34° 30′ 37.81″. Longitude, 94° 49′ 48.38″.]

To station—	Azimuth.	Back azimuth.	Log. distance.
	° ′ ″	° ′ ″	*Meters.*
Thunderbolt	43 47 32.70	223 40 33.36	4.4377864
Hardscrabble	318 23 41.50	138 33 09.17	4.5881731

THUNDERBOLT, CHOCTAW NATION.

In the southwest corner of T. 2 S., R. 22 E., on highest point in the vicinity. A rough road from Noel's store to Mount Zion passes about 3 miles north from station at point 6 miles from latter. From corner of Ts. 2 and 3 N., Rs. 21 and 22 E., station may be reached by going east 44.13 chains on line between secs. 6 and 31, thence north 6.25 chains. Theodolite elevated 24 feet.

Station mark: A pine tree about 45 feet high with a copper bolt marked U. S. G. S. set in it about 4 feet above ground. All limbs were cut from tree except a small bunch left at the top for signal.

[Latitude, 34° 19′ 55.23″. Longitude, 95° 02′ 09.82″.]

To station—	Azimuth.	Back azimuth.	Log. distance.
	° ′ ″	° ′ ″	*Meters.*
Dexter	130 50 35.53	310 37 44.32	4.6618115
Kiamichi	212 13 06.61	32 20 44.63	4.5872205
Base line	223 40 33.36	43 47 32.70	4.4377864
Polecat	241 21 11.80	61 40 42.89	4.7788619
Hardscrabble	281 30 08.06	101 46 32.38	4.6591764
Garvin	346 04 42.70	166 08 33.69	4.6427670
Noel	40 06 55.36	220 00 06.08	4.4613892

HARDSCRABBLE, CHOCTAW NATION.

On the highest of several timbered hills. All timber was cut from summit of hill except an oak tree, which was left for signal. There is a small farm rented by Mr. Jacobs about three-fourths of a mile south from hill. Road from Hatton Gap, Arkansas, to Eagletown, Indian Territory, passes within 3 miles of station at point where road to Jacobs's farm leaves main road. From quarter corner between secs. 26 and 35, T. 3 S., R. 26 E., station bears S. 9° W., 57 chains distant.

Station mark: Copper bolt set in the lone oak signal tree.

[Latitude, 34° 14′ 56.52″. Longitude, 94° 33′ 03.07″.]

To station—	Azimuth.	Back azimuth.	Log. distance.
	° ′ ″	° ′ ″	*Meters.*
Garvin	45 46 31.78	225 34 03.05	4.6799561
Thunderbolt	101 46 32.38	281 30 08.06	4.6591764
Base line	138 33 09.17	318 23 41.50	4.5881731
Kiamichi	150 18 45.73	330 09 55.23	4.6834888
Polecat	192 14 32.78	12 17 35.04	4.5882821

GARVIN, CHOCTAW NATION.

In T. 7 S., R. 23 E., on highest point of flat timbered ridge about 1 mile north from Garvin post-office. Road running north from Garvin passes about 40 yards west of station at a point 1 mile from former. Theodolite elevated 20 feet.

Station mark: A copper bolt set in a post-oak tree.

[Latitude, 33° 56′ 51.14″. Longitude, 94° 55′ 18.63″.]

To station—	Azimuth.	Back azimuth.	Log. distance.
	° ′ ″	° ′ ″	*Meters.*
Noel	125 08 33.15	304 57 55.50	4.5526062
Thunderbolt	166 08 33.69	346 04 42.70	4.6427670
Hardscrabble	225 34 03.05	45 46 31.78	4.6799561

NOEL, CHOCTAW NATION.

On timbered hill about 5 miles southeast from Noel's store, which is in sec. 27, T. 4 S., R. 19 E. Road running southeast from store passes about 1 mile north from station. The highest timber was cut from summit of hill. The corner common to secs. 7, 8, 17, and 18, T. 5 S., R. 20 E., may be reached from station by going due west 21.70 chains to north-south line, thence south 24.45 chains. Theodolite elevated 20 feet.

Station mark: A lone tree.

[Latitude, 34° 07′ 56.53″. Longitude, 95° 14′ 17.77″.]

To station—	Azimuth.	Back azimuth.	Log. distance.
	° ′ ″	° ′ ″	*Meters.*
Thunderbolt	220 00 06.08	40 06 55.36	4.4613892
Garvin	304 57 55.50	125 08 33.15	4.5526062

KOSOMA, CHOCTAW NATION.

On a bluff about 1½ miles west of the wagon road from Kosoma to Tuskahoma and about 3 miles north of Kosoma. To reach station, take road northward from Kosoma for 2 miles, thence west by road which can be followed to top of ridge on which station is located. The corner common to secs. 3, 4, 9, and 10, T. 2 S., R. 16 E., may be reached from station by going N. 0° 01′ W. 0.01 chain, thence west 18.19 chains.

[Latitude, 34° 24′ 07.20″. Longitude, 95° 37′ 05.90″.]

To station—	Azimuth.	Back azimuth.	Log. distance.
	° ′ ″	° ′ ″	*Meters.*
Hewitt	156 47 34.00	336 43 52.60	4.4025800
Dexter	220 03 43.28	40 10 38.45	4.4626567

POTEAU, CHOCTAW NATION.

On a high mountain 15 miles south of Cameron station; summit has considerable timber on it. From corner of secs. 5, 6, 7, and 8, T. 5 N., R. 27 E., station bears S. 19.12 chains and W. 17.90 chains.

Station mark: A lone oak tree, trimmed.

[Latitude, 34° 55′ 27.90″. Longitude, 94° 29′ 25.12″.]

To station—	Azimuth.	Back azimuth.	Log. distance.
	° ′ ″	° ′ ″	*Meters.*
Winding Stair	66 13 40.12	245 59 43.58	4.6093287
Cavanal	133 25 57.21	313 19 28.38	4.3739002
Sugarloaf	190 17 55.18	10 18 41.69	4.0608964
Peak	212 58 14.23	33 02 18.15	4.2966365

SUGARLOAF, CHOCTAW NATION.

On a high and well-known mountain, 7 miles southeast of Cameron station, near the Arkansas line. All timber has been cleared from summit. From the corner of secs. 4 and 5, north boundary T. 6 N., R. 27 E., station may be reached by going south 14.62 chains, thence east 6.25 chains.

Station mark: Copper bolt set in a large flat ledge.

[Latitude, 35° 01′ 35.23″. Longitude, 94° 28′ 03.98″.]

To station—	Azimuth.	Back azimuth.	Log. distance.
	° ′ ″	° ′ ″	*Meters.*
Poteau	10 18 41.69	190 17 55.18	4.0608964
Cavanal	104 25 23.59	284 18 07.67	4.2979498
Peak	238 45 43.46	58 49 01.09	4.0084853

PEAK, SEBASTIAN COUNTY, ARKANSAS.

On a sharp summit of Sugarloaf Mountain, about 6 miles northeast of the highest summit (Sugarloaf Peak).

Station mark: A rock monument.

[Latitude, 35° 04′ 26.71″. Longitude, 94° 22′ 19.84″.]

To station—	Azimuth.	Back azimuth.	Log. distance.
	° ′ ″	° ′ ″	*Meters.*
Poteau	33 02 18.15	212 58 14.23	4.2966365
Sugarloaf	58 49 01.09	238 45 43.46	4.0084852
Cavanal	89 21 15.63	269 10 41.71	4.4464401

DEXTER, COOK COUNTY, TEXAS.

On the highest point of flat ridge N. 69° E. and 0.7 mile distant from the town of Dexter and on the south edge of the timber extending east from same town. Theodolite elevated 40 feet.

Station mark: A copper bolt set in a sandstone rock flush with the surface of the ground, from which bears (counting from the south point around to the west) the following trees: A post oak 14 inches in diameter, 33° 35′, distance 31.7 feet; a post oak 14 inches in diameter, 135° 06′, distance 27.8 feet; a post oak 10 inches in diameter, 189° 02′, distance 78.7 feet. Each tree is blazed and marked U. S. G. S. △ B. T.

[Latitude, 33° 49′ 14.91″. Longitude, 96° 57′ 08.08″.]

To station—	Azimuth.	Back azimuth.	Log. distance.
	° ′ ″	° ′ ″	*Meters.*
Marietta	131 53 04.24	311 48 32.48	4.2259004
Cliff	224 58 33.06	45 06 10.47	4.4738536
Fink	273 30 48.99	93 38 36.99	4.3358726
Good	294 12 01.76	114 22 11.70	4.4911465
Morman Grove	320 23 13.12	140 31 41.84	4.5693849
County line	5 07 34.25	185 07 12.35	4.0551508
Provence	172 35 41.10	352 33 59.26	4.5589067

COUNTY LINE, COOK COUNTY, TEXAS.

On the summit of the eastern one of two timbered hills in Cook County, Texas. It bears N. 37° W., 5.4 miles from the town of Whitesboro in Grayson County, and S. 86° W., 1 mile from County Line post-office. Theodolite elevated 40 feet.

Station mark: A copper bolt set in a sandstone rock, from which bears (counting from the south point around to the west): A black jack tree 5 inches diameter, 71° 09′, distance 59.7 feet; a post oak tree 7 inches diameter, 151° 54′, distance 40.3 feet; a post oak tree 8 inches diameter, 188° 54′, distance 46.5 feet; a post oak tree 5 inches in diameter, 316° 35′, distance 40.5 feet. Each tree is blazed and marked. U. S. G. S. △ B. T.

[Latitude, 33° 43′ 07.86″. Longitude, 96° 57′ 47.48″.]

To station—	Azimuth.	Back azimuth.	Log. distance.
	° ′ ″	° ′ ″	*Meters.*
Marietta	152 56 34.40	332 52 25.05	4.4032722
Dexter	185 07 12.35	5 07 34.25	4.0551508
Fink	246 12 30.66	66 20 39.94	4.3935107
Good	272 43 05.11	92 53 36.11	4.4670038
Morman Grove	304 59 30.94	125 08 20.82	4.4787932

FINK, GRAYSON COUNTY, TEXAS.

On a timbered hill that bears N. 50° W., distant 4.5 miles from the town of Pottsboro, Grayson County, Texas, and about 100 yards north of the road from Funk post-office to Bounds Ferry on Red River, and distant 2.4 miles westerly from Funk post-office. Theodolite elevated 40 feet.

Station mark: A copper bolt set in a sandstone rock placed flush with the surface of the ground, from which the following trees bear (counting from the south point around to the west): A post oak, 14 inches diameter, 90° 04′, distance 46.5 feet; a post oak, 12 inches diameter, 137° 54′, distance 38.6 feet; a post oak, 16 inches diameter, 259° 12′, distance 18.5 feet; a black-jack, 12 inches diameter, 356° 49′, distance 49.3 feet. Each tree is blazed and marked "U. S. G. S. △ B. T."

[Latitude, 33° 48′ 31.01″. Longitude, 96° 43′ 07.12″.]

To station—	Azimuth.	Back azimuth.	Log. distance.
	° ′ ″	° ′ ″	*Meters.*
Good	329 53 02.91	149 55 25.45	4.1194420
County line	66 20 39.94	246 12 30.66	4.3935107
Dexter	93 38 36.99	273 30 48.99	4.3358726
Cliff	178 36 32.86	358 36 21.04	4.3500409

GOOD, GRAYSON COUNTY, TEXAS.

On the summit of a flat ridge between Pottsboro and Sherman, bearing S. 17° E., distant 3.8 miles from the town of Pottsboro, and on the premises of the "widow Good," about 50 yards east of the road between Pottsboro and Sherman. Theodolite elevated 20 feet.

Station mark: A copper bolt set in a sandstone rock which is flush with the surface of the ground, from which the southwest corner of widow Good's house bears (counting from the south point around to west) 349° 18′; distance, 142.6 feet.

[Latitude, 33° 42′ 21.29″. Longitude, 96° 38′ 50.59″.]

To station—	Azimuth.	Back azimuth.	Log. distance.
	° ′ ″	° ′ ″	Meters.
Mormon Grove	16 20 39.89	196 18 59.97	4.2183856
County line	92 53 36.11	272 43 05.11	4.4670038
Dexter	114 22 11.70	294 12 01.76	4.4911465
Fink	149 55 25.45	329 53 02.91	4.1194420
Cliff	168 05 12.03	248 02 37.31	4.5380660

MORMON GROVE, GRAYSON COUNTY, TEXAS.

On the premises of J. D. Hall, 550 feet northeast of Mormon Grove post-office, which is S. 45½° W., distant 7.18 miles from the courthouse at Sherman. The station is in a cultivated field about 25 yards north of Hall's peach orchard.

Station mark: A copper bolt set in a rock placed 2 feet below the surface of the ground; also marked by a cross in the vertical line through center of copper bolt cut in a rock placed flush with the surface of the ground, from which the northeast corner of an implement house bears (counting from the south point to west) 61° 54′; distance, 151.9 feet.

[Latitude, 33° 33′ 46.27″. Longitude, 96° 41′ 50.98″.]

To station—	Azimuth.	Back azimuth.	Log. distance.
	° ′ ″	° ′ ″	Meters.
County line	125 08 20.82	304 59 30.94	4.4787932
Dexter	140 31 41.84	320 23 13.12	4.5693849
Good	196 18 59.97	16 20 39.89	4.2183856

SPIRIT LEVELING.

The elevations in the following list are based on bench mark XLI of the United States Coast and Geodetic Survey, located at Fort Smith, Arkansas. This mark was placed in 1889, and is a copper bolt leaded in the west wall of the United States jail (brick). The bolt is in the first course above the limestone base, and about 1 meter above the ground. It is in the fifth brick from the panel formed by the side of the building and the brick ventilator. The jail is a new pressed-brick addition to the old United States building. A cross was cut in the end of the bolt, and the intersection of the lines forming the cross is the bench mark. The letters "U. S. B. M." were cut in the base stone immediately below the bolt. Height above the mean level of the Gulf, 446.29 feet.

From this bench mark two lines of levels were run, one over the St. Louis, Iron Mountain and Southern Railway to Wagoner, Indian Territory; then south over the Missouri, Kansas and Texas Railway to milepost No. 519, where a closure of 0.430 feet was made on the other line of levels which had been run from Fort Smith, Arkansas, over the St. Louis and San Francisco Railroad to Wister, Indian Territory; then west over the Choctaw, Oklahoma and Gulf Railroad to South McAlester, Indian Territory; then north over the Missouri, Kansas and Texas Railway to mile pole No. 519. The level lines from Fort Smith, Arkansas, to Wagoner, Indian Territory, and Fort Smith, Arkansas, to South McAlester, Indian Territory, were run by two levelmen over each line. Messrs. J. Phelan and C. H. Hickman started the line from Fort Smith, Arkansas, to Wagoner, Indian Territory, but were afterwards relieved by Messrs. A. F. Hassan and R. Coe. Messrs. R. Coe and G. A. Purington started the line from Fort Smith, Arkansas, to South McAlester, Indian Territory, but Mr. Coe was afterwards relieved by Mr. H. C. McCluer. The remainder of the railroad levels were run by a single levelman using two rods. From Wister, Indian Territory, Mr. H. C. McCluer ran south over the St. Louis and San Francisco Railroad to Paris, Texas; and then west over the Texas and Pacific Railway to Sherman, Texas, where a closure of 0.915 feet was made with line run by Messrs. G. A. Purington and W. R. Manning south over the Missouri, Kansas and Texas Railway to Sherman, Texas. Starting from Denison, Texas, on the Missouri, Kansas and Texas Railway, Messrs. R. Coe and R. T. Carnall ran west over said line to Gainesville, Texas. From that point the line was carried north by Messrs. R. Coe and A. F. Hassan over the Gulf, Colorado and Santa Fe Railway to Oklahoma City, Oklahoma Territory; then east by Mr. R. Coe over the Choctaw, Oklahoma and Gulf Railroad to mile pole No. 66, near Dale, Oklahoma Territory, where a closure of 0.146 feet was made with line brought west by Mr. E. L. Faison from South McAlester, Indian Territory, over the Choctaw, Oklahoma and Gulf Railroad. From Oklahoma City, Oklahoma Territory, Mr. R. Coe ran west over the Choctaw, Oklahoma and Gulf Railroad to Fort Reno, Oklahoma Territory, and then south from El Reno Junction, Oklahoma Territory, over the Chicago, Rock Island and Pacific Railway through Indian Territory to the Red River. Then returning a few miles north to the intersection of the railway with the first standard parallel south, of the Chickasaw Survey, he ran east along the said parallel to the Indian meridian, where he made a closure of 0.566 feet on the line of levels extended by Mr. J. H. Carlock westward from the Gulf, Colorado and Santa Fe Railway to the Indian meridian. Elevations of the portions of this circuit that lay in Oklahoma Territory have been included by Mr. J. H. Renshawe, topographer, in the report for the fiscal year 1897-98.

From Wagoner, Indian Territory, levels were run north by Messrs. A. F. Hassan, C. B. Odell, and R. Coe, over the Missouri, Kansas and Texas Railway to Chetopah, Kansas, and from there west by Mr. R. Coe, over the Missouri Pacific Railway to Coffeyville, Kansas, making a closure of 1.009 feet on line run north from Wagoner, Indian Territory, by Mr. C. B. Odell over the St. Louis, Iron Mountain and Southern Railway to Coffeyville, Kansas. Levels were also run on the St. Louis and San Francisco Railroad from Sapulpa, Indian Territory, to its intersection with the Indian Territory-Missouri line, crossing the St. Louis, Iron Mountain and Southern Railway at Claremore, Indian Territory, and the Missouri, Kansas and Texas Railway at Vinita, Indian Territory; along the Kansas City, Pittsburg and Gulf Railroad, from the Indian Territory-Arkansas line, near Page, Indian Territory, north to Siloam Springs, Arkansas, crossing the St. Louis and San Francisco Railroad near Poteau, Indian Territory, and St. Louis, Iron Mountain and Southern Railway near Sallisaw, Indian Territory.

It will be seen from the above résumé that Indian Territory has been well controlled by double-rodded lines along the various railroads, all so run as to form closed circuits, which have all closed quite satisfactorily considering the conditions of extreme heat and cold, as well as high winds, which existed at various times during the work. These lines along the railroads were used as precise levels, and all land lines were connected to these at the points of intersection.

All permanent bench marks were stamped to the nearest foot.

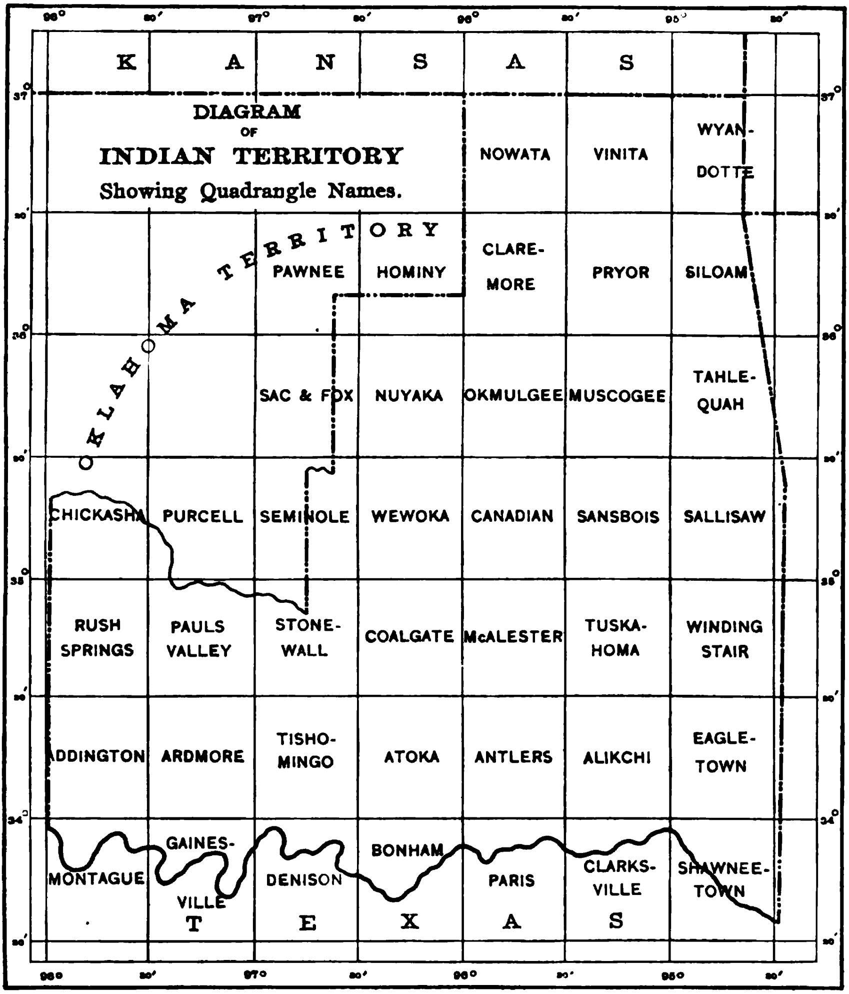

FIG. 1.—Map of Indian Territory showing quadrangle names.

WYANDOTTE QUADRANGLE.

Mr. A. F. Hassan ran the railroad levels. Mr. George Nick was attached to the subdivision and topographic party of Mr. D. C. Harrison, and Messrs. W. E. Earle and H. L. Muldrow, jr., to Mr. R. H. McKee's party.

FROM AFTON, ALONG THE ST. LOUIS AND SAN FRANCISCO RAILROAD, TO MISSOURI-SHAWNEE BOUNDARY LINE.

	Feet.
Afton, ½ mile north of; copper bolt sunk into coping stone on south side of west abutment of bridge 245, over Horse Creek	773.867
Fairland, 1 mile south of; spike in mile pole 343	819.048

	Feet.
Fairland, 5 miles north of; spike in mile pole 337	734.505
Wyandotte, 2 miles south of; copper bolt sunk into south coping stone of west abutment of bridge over Grand River	743.078
Wyandotte, 5 miles north of; copper bolt sunk into stone on south side of west pier, bridge 222, over Lees Creek	814.347
Missouri-Shawnee boundary line; iron post set 10 feet north of track and 4 feet south of "State Line" signboard	846.411

ALONG TOWNSHIP AND SECTION LINES.

Closing corner T. 28 N., Rs. 21 and 22 E., iron post	772.234
Grand River meander corner between sec. 6, T. 28 N., R. 22 E., and sec. 35, T. 29 N., R. 21 E.; iron post on right bank of	773.010
Grand River meander corner between sec. 6, T. 27 N., R. 23 E., and sec. 31, T. 28 N., R. 23 E.; iron post on right bank of	740.090
Corner Ts. 27 and 28 N., Rs. 22 and 23 E., iron post	771.642
Corner Ts. 27 and 28 N., Rs. 21 and 22 E., iron post	807.345
Corner Ts. 26 and 27 N., Rs. 21 and 22 E., iron post	762.992
Corner Ts. 26 and 27 N., Rs. 22 and 23 E., iron post	793.672
Grand River meander corner between sec. 36, T. 27 N., and sec. 1, T. 26 N., R. 23 E.; iron post on right bank of	726.994
Grand River meander corner between sec. 32, T. 26 N., and sec. 5, T. 25 N., R. 24 E.; iron post on right bank of	701.431
Corner Ts. 25 and 26 N., Rs. 23 and 24 E., iron post	735.451
Corner Ts. 25 and 26 N., Rs. 22 and 23 E., iron post	849.611
Corner Ts. 25 and 26 N., Rs. 21 and 22 E., iron post	778.761
Standard corner T. 25 N., Rs. 21 and 22 E., iron post	834.693
Closing corner T. 24 N., Rs. 22 and 23 E., iron post	698.113
Standard corner T. 25 N., Rs. 22 and 23 E., iron post	734.553
Closing corner T. 24 N., Rs. 23 and 24 E., iron post	754.643
Standard corner T. 25 N., Rs. 23 and 24 E., iron post	751.273
Closing corner T. 24 N., Rs. 24 and 25 E., iron post	877.443
Standard corner T. 25 N., Rs. 24 and 25 E., iron post	875.973
Missouri-Cherokee boundary line, closing corner Ts. 24 and 25 N., R. 25 E., iron post	903.793
Seneca-Cherokee boundary line, closing corner T. 25 N., Rs. 23 and 24 E., iron post	772.163
Seneca-Cherokee boundary line, closing corner T. 25 N., Rs. 24 and 25 E., iron post	832.883
Seneca-Cherokee boundary line, intersection of the, with the west boundary line of Missouri, T. 25 N., R. 25 E., of Indian Territory Survey, iron post	751.113
Arkansas-Cherokee boundary line, closing corner Ts. 23 and 24 N., R. 25 E., iron post	1,030.273
Corner Ts. 23 and 24 N., Rs. 24 and 25 E., iron post	1,029.483
Corner Ts. 23 and 24 N., Rs. 23 and 24 E., iron post	900.453
Corner Ts. 23 and 24 N., Rs. 22 and 23 E., iron post	893.849

VINITA QUADRANGLE.

The railroad levels were run by Messrs. R. Coe, C. B. Odell, and A. F. Hassan. Mr. C. B. Odell had charge of an independent level party. Mr. G. Nick was attached to the subdivision and topographic party of Mr. D. C. Harrison, and Messrs. E. W. Hill, W. E. Earle, and A. F. Hassan were with Mr. R. H. McKee's party.

FROM BIG CABIN, ALONG THE MISSOURI, KANSAS AND TEXAS RAILWAY, TO KANSAS-CHEROKEE BOUNDARY LINE.

	Feet.
Big Cabin, 2 miles north of; spike in telegraph mile pole 445	690.998
Big Cabin, 3¾ miles north of; copper bolt set into angle coping stone of east side of north abutment of bridge 227 over Whiteoak Creek near mile pole 443	667.232
Vinita; iron post in northwest angle of Missouri, Kansas and Texas and St. Louis and San Francisco railroads; 13.8 feet west of the Missouri, Kansas and Texas track and 22.9 feet north of the St. Louis and San Francisco track, 4.2 feet north of a telegraph pole	695.216
Vinita; bronze tablet set into second stone from north end of second course of foundation stone above sidewalk of Hotel Cobb, which is a brick building owned by S. S. Cobb	702.469
Kelso, ⅘ mile north of; copper bolt sunk into bottom stone of east side of south abutment of bridge 220, 160 feet north of mile pole 433	748.998
Bluejacket; square hole cut in sandstone post, 4 by 13 inches, surface flush with ground, situated between main track and "house track," south of station building; 22.9 feet from west rail of main track, 21.5 feet from east rail of house track, and 42.4 feet from south end of building	773.565
Bluejacket, 2 miles north of; ¼ mile north of mile pole 425; copper bolt sunk into seat stone, 8 inches from west edge of, on west side of south abutment of bridge 217	761.622
Welch, 2 miles north of; spike in first telegraph pole south of mile pole 419	852.864
Russell Creek, 2 miles north of; copper bolt sunk into first step on east side of north abutment of bridge 213, 1,400 feet north of mile pole 414	798.416
Kansas-Cherokee boundary line, intersection of railroad with; square hole in sandstone post 14 by 14 by 5 inches, flush with ground, 49.6 feet from west rail of track and referenced by three posts situated as follows: 3.4 feet northwest, 2.5 feet east, and 4 feet southwest from stone	835.495

FROM CHELSEA, ALONG THE ST. LOUIS AND SAN FRANCISCO RAILROAD, TO ALBIA.

Chelsea; copper bolt in sandstone post 8 by 10 by 22 inches, buried flush with ground, 11.5 feet from northwest corner of station building and 15.6 feet from east rail of track	715.147
Chelsea; bronze tablet set into northeast corner of stone building, corner of Olive and Fifth streets, used as a bank building	717.951
Chelsea, 6 miles northeast of; spike in milepole 375	798.641
Vinita, 7 miles southwest of; spike in milepole 369	760.078
Vinita, 1 mile west of; copper bolt sunk into southwest coping stone of south abutment of bridge over Big Cabin Creek	676.091
Albia, 1⅗ miles southwest of; spike in milepole 356	694.676

ALONG TOWNSHIP LINES.

Kansas-Cherokee boundary line, closing corner T. 29 N., Rs. 17 and 18 E., iron post	900.945
Kansas-Cherokee boundary line, closing corner T. 29 N., Rs. 18 and 19 E., iron post	934.823
Kansas-Cherokee boundary line, closing corner T. 29 N., Rs. 19 and 20 E., iron post	905.385

	Feet.
Kansas-Cherokee boundary line, closing corner T. 29 N., Rs. 20 and 21 E., iron post	827.024
Kansas-Cherokee boundary line, iron post set by the side of the "Zero" milepost and 400 feet west of the Neosho or Grand River	780.029
Standard corner T. 29 N., Rs. 20 and 21 E., iron post	833.01
Closing corner T. 28 N., Rs. 20 and 21 E., iron post	887.803
Standard corner T. 29 N., Rs. 19 and 20 E., iron post	945.791
Closing corner T. 28 N., Rs. 19 and 20 E., iron post	894.94
Standard corner T. 29 N., Rs. 18 and 19 E., iron post	956.136
Closing corner T. 28 N., Rs. 18 and 19 E., iron post	894.876
Standard corner T. 29 N., Rs. 17 and 18 E., iron post	827.136
Closing corner T. 28 N., Rs. 17 and 18 E., iron post	845.136
Corner Ts. 27 and 28 N., Rs. 17 and 18 E., iron post	803.09
Corner Ts. 27 and 28 N., Rs. 18 and 19 E., iron post	823.876
Corner Ts. 27 and 28 N., Rs. 19 and 20 E., iron post	956.03
Corner Ts. 27 and 28 N., Rs. 20 and 21 E., iron post	791.09
Corner Ts. 26 and 27 N., Rs. 20 and 21 E., iron post	772.0
Corner Ts. 26 and 27 N., Rs. 19 and 20 E., iron post	755.931
Corner Ts. 26 and 27 N., Rs. 18 and 19 E., iron post	827.232
Corner Ts. 26 and 27 N., Rs. 17 and 18 E., iron post	777.0
Corner Ts. 25 and 26 N., Rs. 17 and 18 E., iron post	733.31
Corner Ts. 25 and 26 N., Rs. 18 and 19 E., iron post	794.337
Corner Ts. 25 and 26 N., Rs. 19 and 20 E., iron post	718.291
Corner Ts. 25 and 26 N., Rs. 20 and 21 E., iron post	739.321
Closing corner T. 24 N., Rs. 21 and 22 E., iron post	821.033
Standard corner T. 25 N., Rs. 20 and 21 E., iron post	673.056
Closing corner T. 24 N., Rs. 20 and 21 E., iron post	716.113
Standard corner T. 25 N., Rs. 19 and 20 E., iron post	686.426
Closing corner T. 24 N., Rs. 19 and 20 E., iron post	696.767
Standard corner T. 25 N., Rs. 18 and 19 E., iron post	909.0
Closing corner T. 24 N., Rs. 18 and 19 E., iron post	895.888
Standard corner T. 25 N., Rs. 17 and 18 E., iron post	785.896
Corner Ts. 23 and 24 N., Rs. 17 and 18 E., iron post	709.701
Corner Ts. 23 and 24 N., Rs. 18 and 19 E., iron post	840.127
Corner Ts. 23 and 24 N., Rs. 19 and 20 E., iron post	682.269
Witness corner to Ts. 23 and 24 N., Rs. 20 and 21 E., iron post	656.663
Corner Ts. 23 and 24 N., Rs. 21 and 22 E., iron post. (This bench mark is just north of the Vinita quadrangle and on the Missouri, Kansas and Texas Railway.)	820.059
Chetopah, Kansas; bronze tablet set in center of corner stone on east side of entrance and in first course of stone above foundation of public-school building	823.701

NOWATA QUADRANGLE.

Mr. C. B. Odell ran the railroad levels; Mr. W. S. D. Moore had an independent level party; Messrs. G. Nick and J. P. Thayer were attached to the subdivision and topographic party of Mr. D. C. Harrison, and Mr. A. F. Hassan was with Mr. R. H. McKee's party.

FROM TALALA, ALONG ST. LOUIS, IRON MOUNTAIN AND SOUTHERN RAILWAY, TO SEMINOLE.

	Feet.
Talala; copper bolt in sandstone post 7 by 9 by 18 inches, buried flush with ground, 8.6 feet from southeast corner of station building	683.305
Watova, 2 miles south of; telegraph milepole 639	693.476
Nowata, 2 miles south of; spike in second telegraph pole north of milepole 645	703.138
Nowata; copper bolt in sandstone post 8 by 8 by 26 inches, buried flush with ground, 8.7 feet south from southeast corner of station building and 14 feet from track	693.5
Nowata; bronze tablet set into sandstone sill, northeast corner of J. H. Bartlett's "City Dry Goods Store"	702.419
Nowata, 3 miles north of; square hole cut into second capstone from east end of center pier bridge over California Creek	660.791
Lenapah, 3 miles north of; spike in milepole 654	750.384
Seminole, 3 miles south of; spike in milepole 660	707.496
Seminole, 3 miles south of; spike in milepole 666	716.356
Seminole, 4 miles north of; copper bolt sunk into sandstone post 6 by 8 by 24 inches, buried flush with ground, 8.8 feet west of track and 1.4 feet from post marking intersection of railroad and Kansas-Cherokee boundary line, which is near thirty-fourth milepost of boundary line	730.504

ALONG TOWNSHIP AND SECTION LINES.

Kansas-Cherokee boundary line, closing corner Osage-Cherokee boundary line, T. 29 N., R. 12 E., iron post	941.681
Kansas-Cherokee boundary line, closing corner T. 29 N., Rs. 12 and 13 E., iron post	719.136
Kansas-Cherokee boundary line, closing corner T. 29 N., Rs. 13 and 14 E., iron post	806.136
Kansas-Cherokee boundary line, closing corner T. 29 N., Rs. 14 and 15 E., iron post	872.951
Kansas-Cherokee boundary line, closing corner T. 29 N., Rs. 15 and 16 E., iron post	735.205
Kansas-Cherokee boundary line, closing corner T. 29 N., Rs. 16 and 17 E., iron post	757.205
Standard corner T. 29 N., Rs. 16 and 17 E., iron post	808.136
Closing corner T. 28 N., Rs. 16 and 17 E., iron post	737.136
Standard corner T. 29 N. Rs. 15 and 16 E., iron post	713.354
Closing corner T. 28 N., Rs. 15 and 16 E., iron post	758.337
Standard corner T. 29 N., Rs. 14 and 15 E., iron post	946.136
Closing corner T. 28 N., Rs. 14 and 15 E., iron post	919.919
Standard corner T. 29 N., Rs. 13 and 14 E., iron post	781.136
Closing corner T. 28 N., Rs. 13 and 14 E., iron post	740.226
Standard corner T. 29 N., Rs. 12 and 13 E., iron post	704.136
Closing corner T. 28 N., Rs. 12 and 13 E., iron post	741.419
Osage-Cherokee boundary line, closing corner Ts. 28 and 29 N., R. 12 E., iron post	793.136
Osage-Cherokee boundary line, closing corner Ts. 27 and 28 N., R. 12 E., iron post	692,269
Corner Ts. 27 and 28 N., Rs. 12 and 13 E., iron post	688.011
Corner Ts. 27 and 28 N., Rs. 13 and 14 E., iron post	799.349

	Feet.
Corner Ts. 27 and 28 N., Rs. 14 and 15 E., iron post	845.989
Triangulation station; northeast part of NW. ¼ sec. 5, T. 28 N., R. 15 E., copper bolt in stone, 20 feet left of signal tower	968.497
Corner Ts. 27 and 28 N., Rs. 15 and 16 E., iron post	795.869
Corner Ts. 27 and 28 N., Rs. 16 and 17 E., iron post	707.841
Corner Ts. 26 and 27 N., Rs. 16 and 17 E., iron post	738.937
Corner Ts. 26 and 27 N., Rs. 15 and 16 E., iron post	688.804
Corner Ts. 26 and 27 N., Rs. 14 and 15 E., iron post	895.509
Corner Ts. 26 and 27 N., Rs. 13 and 14 E., iron post	813.747
Corner Ts. 26 and 27 N., Rs. 12 and 13 E., iron post	667.491
Osage-Cherokee boundary line, closing corner Ts. 26 and 27 N., R. 12 E., iron post	672.977
Osage-Cherokee boundary line, closing corner Ts. 25 and 26 N., R. 12 E., iron post	922.966
Corner Ts. 25 and 26 N., Rs. 12 and 13 E., iron post	654.498
Corner Ts. 25 and 26 N., Rs. 13 and 14 E., iron post	717.625
Corner Ts. 25 and 26 N., Rs. 14 and 15 E., iron post	761.842
Triangulation signal; south central part of SW. ¼ sec. 33, T. 26 N., R. 15 E., copper bolt set in stone 6 inches square	903.057
Corner Ts. 25 and 26 N., Rs. 15 and 16 E., iron post	690.122
Corner Ts. 25 and 26 N., Rs. 16 and 17 E., iron post	641.31
Standard corner T. 25 N., Rs. 16 and 17 E., iron post	648.0
Closing corner T. 24 N., Rs. 16 and 17 E., iron post	636.232
Standard corner T. 25 N., Rs. 15 and 16 E., iron post	695.105
Closing corner T. 24 N., Rs. 15 and 16 E., iron post	685.16
Standard corner T. 25 N., Rs. 14 and 15 E., iron post	811.02
Closing corner T. 24 N., Rs. 14 and 15 E., iron post	807.88
Standard corner T. 25 N., Rs. 13 and 14 E., iron post	626.605
Closing corner T. 24 N., Rs. 13 and 14 E., iron post	627.995
Standard corner T. 25 N., Rs. 12 and 13 E., iron post	733.698
Closing corner T. 24 N., Rs. 12 and 13 E., iron post	731.888
Osage-Cherokee boundary line, closing corner Ts. 24 and 25 N., R. 12 E., iron post	840.708
Osage-Cherokee boundary line, closing corner Ts. 23 and 24 N., R. 12 E., iron post	879.665
Corner Ts. 23 and 24 N., Rs. 12 and 13 E., iron post	790.083
Corner Ts. 23 and 24 N., Rs. 13 and 14 E., iron post	613.463
Corner Ts. 23 and 24 N., Rs. 14 and 15 E., iron post	694.357
Corner Ts. 23 and 24 N., Rs. 15 and 16 E., iron post	763.796
Corner Ts. 23 and 24 N., Rs. 16 and 17 E., iron post	749.749

The following bench marks are situated just north of the Nowata quadrangle, and are on the Missouri Pacific and St. Louis, Iron Mountain and Southern Railways:

	Feet.
Edna, Labette County, Kansas; bronze tablet in middle of bottom stone of north column of stone store building, owned by G. W. Reason, and used as a grocery by Arnold Bros	974.0497
Coffeyville, Kansas; copper bolt in sandstone post, 6 by 8 by 24 inches flush with ground near Missouri Pacific station building, and 1.8 feet south of station, 20.1 feet north of north rail	743.778
Coffeyville, Kansas; bronze tablet on base of pilaster of red sandstone in the Ried Building, on the southeast corner of Walnut and Ninth streets, and in northwest corner of building	731.372

Google

CLAREMORE QUADRANGLE.

Mr. C. B. Odell ran the railroad levels. Messrs. W. S. D. Moore and C. B. Odell had independent level parties. Mr. A. F. Hassan was attached to the subdivision and topographic party of Mr. R. H. McKee, and Mr. J. P. Thayer to Mr. D. C. Harrison's party.

FROM INOLA, ALONG THE ST. LOUIS, IRON MOUNTAIN AND SOUTHERN RAILWAY, TO OOLOGAH.

	Feet.
Inola; copper bolt sunk into sandstone post, 4 by 6 by 24 inches, buried flush with surface and 10.2 feet from the southeast corner of station building	599.821
Inola, 6 miles north of; spike in mile pole 609	601.201
Claremore; bronze tablet set into top course of foundation stone of First National Bank Building, on the southwest corner of same. Building situated on the northeast corner of Third street and Wichita avenue	599.077
Claremore; copper bolt sunk into sandstone post 8 by 8 by 18 inches, 9.1 feet south from southeast corner of station building, 12.6 feet west of St. Louis, Iron Mountain and Southern track	607.01
Claremore, 1 mile north of; copper bolt sunk into sandstone post 6 by 9 by 20 inches, flush with surface, 7.8 feet east of St. Louis, Iron Mountain and Southern Railway, and 7.8 feet west of St. Louis and San Francisco Railroad tracks, 27.6 feet north of the intersection of these roads	611.164
Sageeyah; (+) cross on sandstone post 9 by 9 by 18 inches, 10 feet west of track and 12 feet south from southeast corner of station building	643.515
Sageeyah, 1 mile north of; "U. S. B. M." stamped in southeast iron tube near center of bridge structure over Verdigris River	592.489
Oologah; copper bolt sunk into stone 7 by 9 by 17 inches, 10.7 feet from south end of station and 12 feet from track, and buried flush with surface	654.614

FROM CLAREMORE, ALONG THE ST. LOUIS AND SAN FRANCISCO RAILROAD, TO TULSA.

Claremore, 6 miles north of; spike in mile pole 392	687.785
Claremore; St. Louis and San Francisco Railroad station; copper bolt sunk into sandstone post 8 by 8 by 20 inches, 10.4 feet from northwest corner of building, 18.7 feet east of track and buried flush with surface	598.687
Verdigris; spike in mile pole 404	619.376
Catoosa, 1 mile north of; copper bolt sunk into capstone on south side of east pier, bridge over Verdigris River	570.724
Catoosa; spike in mile pole 410, opposite station building	617.144
Catoosa, 3 miles south of; spike in mile pole 413	738.043
Tulsa, 6 miles north of; square hole cut in first capstone on south end of east abutment, bridge over Mingo Creek	601.568
Tulsa; copper bolt sunk into sandstone post 8 by 8 by 22 inches, 18.6 feet west of track and 12.7 feet from southeast corner of station building and buried flush with surface	695.127
Tulsa; bronze tablet set into southwest corner stone of second course above sidewalk of stone building known as the Lynch Building	708.038
Tulsa, ½ mile south of; copper bolt sunk into west side of north pier, bridge over Arkansas River	640.95

ALONG TOWNSHIP LINES.

	Feet.
Corner Ts. 22 and 23 N., Rs. 16 and 17 E., iron post	736.19
Corner Ts. 22 and 23 N., Rs. 15 and 16 E., iron post	617.23
Corner Ts. 22 and 23 N., Rs. 14 and 15 E., iron post	663.665
Corner Ts. 22 and 23 N., Rs. 13 and 14 E., iron post	626.285
Corner Ts. 22 and 23 N., Rs. 12 and 13 E., iron post	662.745
Oklahoma-Cherokee boundary line, closing corner Ts. 22 and 23 N., R. 12 E., iron post	644.305
Corner Ts. 21 and 22 N., Rs. 16 and 17 E., iron post	659.045
Corner Ts. 21 and 22 N., Rs. 15 and 16 E., iron post	622.6
Corner Ts. 21 and 22 N., Rs. 14 and 15 E., iron post	717.3
Corner Ts. 21 and 22 N., Rs. 13 and 14 E., iron post	687.345
Corner Ts. 21 and 22 N., Rs. 12 and 13 E., iron post	627.51
Oklahoma-Cherokee boundary line, closing corner Ts. 21 and 22 N., R. 12 E., iron post	618.175
Oklahoma-Cherokee boundary line, closing corner Ts. 20 and 21 N., R. 12 E., iron post	746.34
Closing corner T. 20 N., Rs. 12 and 13 E., iron post	627.185
Standard corner T. 21 N., Rs. 12 and 13 E., iron post	624.61
Closing corner T. 20 N., Rs. 13 and 14 E., iron post	579.08
Standard corner T. 21 N., Rs. 13 and 14 E., iron post	577.995
Closing corner T. 20 N., Rs. 14 and 15 E., iron post	785.005
Standard corner T. 21 N., Rs. 14 and 15 E., iron post	794.135
Closing corner T. 20 N., Rs. 15 and 16 E., iron post	594.316
Standard corner T. 21 N., Rs. 15 and 16 E., iron post	596.516
Closing corner T. 20 N., Rs. 16 and 17 E., iron post	603.427
Standard corner T. 21 N., Rs. 16 and 17 E., iron post	612.905
Corner Ts. 19 and 20 N., Rs. 16 and 17 E., iron post	618.161
Corner Ts. 19 and 20 N., Rs. 15 and 16 E., iron post	644.111
Corner Ts. 19 and 20 N., Rs. 14 and 15 E., iron post	629.821
Corner Ts. 19 and 20 N., Rs. 13 and 14 E., iron post	614.821
Witness corner Ts. 19 and 20 N., Rs. 12 and 13 E., iron post	714.821
Corner Ts. 18 and 19 N., Rs. 12 and 13 E., iron post	627.679
Corner Ts. 18 and 19 N., Rs. 13 and 14 E., iron post	693.349
Corner Ts. 18 and 19 N., Rs. 14 and 15 E., iron post	698.139
Corner Ts. 18 and 19 N., Rs. 15 and 16 E., iron post	749.849
Corner Ts. 18 and 19 N., Rs. 16 and 17 E., iron post	539.579

PRYOR QUADRANGLE.

The railroad levels were run by Messrs. C. B. Odell, A. F. Hassan, and R. Coe. Mr. W. S. D. Moore had charge of an independent level party. Messrs. A. F. Hassan, E. W. Hill, J. P. Phelan, W. E. Earle, and H. L. Muldrow, jr., were attached to the subdivision and topographic party of Mr. R. H. McKee.

ON ST. LOUIS AND SAN FRANCISCO RAILROAD.

	Feet.
Chelsea, 4 miles south of; spike in mile pole 385	749.466

FROM LELIAETTA, ALONG THE MISSOURI, KANSAS AND TEXAS RAILWAY, TO BIG CABIN.

Leliaetta, 2 miles north of; square hole cut in a limestone post, the exposed surface of which is 1.1 feet by 0.45 feet, buried flush with ground between sixth and seventh telegraph poles north of mile pole 482, 50 feet from h telegraph pole, and 27 feet left of track	580.084

	Feet.
Mazie; spike in telegraph mile pole 478	608.725
Choteau; square hole cut in sandstone post 6 by 10 by 18 inches, buried flush with ground 10 feet west of track and 10.5 feet south of station building	625.235
Choteau, 1 mile north of; square hole cut into coping stone west side of south pier, bridge over Choteau Creek	585.294
Pryor Creek, 2 miles south of; square hole cut into coping stone, northwest corner of north abutment bridge 244, over Pryor Creek	595.632
Pryor Creek; $\overset{\text{U. S.}}{\underset{\text{B. M.}}{+}}$ cut in sandstone post 2 by 4 by 24 inches, which is buried flush with ground near southeast corner of station building	625.236
Pryor Creek; bronze tablet set into third course of stone above sidewalk of south end of general merchandise store occupied by J. L. Baugh	630.976
Perry, 2 miles south of; square hole cut into second coping stone of east end of the south abutment bridge 237, near mile pole 460	614.849
Perry, 1 mile north of; copper bolt sunk into east coping stone of south abutment bridge 235, 2,000 feet north of mile pole 457	649.499
Adair, 3 miles north of; copper bolt sunk into top stone of ballast wall on east side of south abutment bridge over Rock Creek, about one-fourth mile north of mile pole 451	661.277
Big Cabin, 3 miles south of; square hole cut into top stone at east end of south abutment bridge 230, near mile pole 450	659.925

ALONG TOWNSHIP LINES.

Corner Ts. 22 and 23 N., Rs. 17 and 18 E., iron post	803.656
Corner Ts. 22 and 23 N., Rs. 18 and 19 E., iron post	633.496
Corner Ts. 22 and 23 N., Rs. 19 and 20 E., iron post	657.896
Corner Ts. 22 and 23 N., Rs. 20 and 21 E., iron post	689.656
Corner Ts. 22 and 23 N., Rs. 21 and 22 E., iron post	854.443
Corner Ts. 21 and 22 N., Rs. 21 and 22 E., iron post	1,013.253
Corner Ts. 21 and 22 N., Rs. 20 and 21 E., iron post	942.151
Corner Ts. 21 and 22 N., Rs. 19 and 20 E., iron post	670.751
Witness corner Ts. 21 and 22 N., Rs. 18 and 19 E., iron post	606.36
Corner Ts. 21 and 22 N., Rs. 17 and 18 E., iron post	797.892
Closing corner T. 20 N., Rs. 17 and 18 E., iron post	626.954
Standard corner T. 21 N., Rs. 17 and 18 E., iron post	628.744
Closing corner T. 20 N., Rs. 18 and 19 E., iron post	618.974
Standard corner T. 21 N., Rs. 18 and 19 E., iron post	620.204
Closing corner T. 20 N., Rs. 19 and 20 E., iron post	655.533
Standard corner T. 21 N., Rs. 19 and 20 E., iron post	660.595
Closing corner T. 20 N., Rs. 20 and 21 E., iron post	891.033
Witness corner to standard corner T. 21 N., Rs. 20 and 21 E., iron post	785.613
Closing corner T. 20 N., Rs. 21 and 22 E., iron post	960.913
Standard corner T. 21 N., Rs. 21 and 22 E., iron post	998.423
Corner Ts. 19 and 20 N., Rs. 21 and 22 E., iron post	1,124.823
Corner Ts. 19 and 20 N., Rs. 20 and 21 E., iron post	900.015
Corner Ts. 19 and 20 N., Rs. 19 and 20 E., iron post	642.685
Corner Ts. 19 and 20 N., Rs. 18 and 19 E., iron post	653.165
Corner Ts. 19 and 20 N., Rs. 17 and 18 E., iron post	626.855
Corner Ts. 18 and 19 N., Rs. 17 and 18 E., iron post	608.054
Corner Ts. 18 and 19 N., Rs. 18 and 19 E., iron post	626.16

	Feet.
Corner Ts. 18 and 19 N., Rs. 19 and 20 E., iron post	883.755
Corner Ts. 18 and 19 N., Rs. 20 and 21 E., iron post	918.786
Corner Ts. 18 and 19 N., Rs. 21 and 22 E., iron post	963.046

SILOAM QUADRANGLE (INDIAN TERRITORY—ARKANSAS).

The railroad levels were run by Messrs. R. Coe and W. S. D. Moore. Messrs. W. E. Earle, G. Nick, E. W. Hill, S. C. Pitts, and H. L. Muldrow, jr., were attached to the subdivision and topographic party of Mr. R. H. McKee.

ALONG THE KANSAS CITY, PITTSBURG AND GULF RAILROAD TO SILOAM SPRINGS, ARKANSAS.

	Feet.
Corner Ts. 18 and 19 N., Rs. 25 and 26 E., iron post 12 chains west from railroad	1,042.878
Intersection of railroad with Arkansas-Cherokee boundary line, iron post.	970.83
Siloam Springs; iron post at southwest corner of platform, 60 feet south of station building and 15 feet west of track	1,148.604

ALONG TOWNSHIP LINES.

Corner Ts. 22 and 23 N., Rs. 22 and 23 E., iron post	1,022.786
Corner Ts. 22 and 23 N., Rs. 23 and 24 E., iron post	1,058.716
Corner Ts. 22 and 23 N., Rs. 24 and 25 E., iron post	1,130.953
Arkansas-Cherokee boundary line, closing corner Ts. 22 and 23 N., R. 25 E., iron post	1,064.453
Arkansas-Cherokee boundary line; witness to closing corner Ts. 21 and 22 N., R. 25 E., iron post	982.812
Corner Ts. 21 and 22 N., Rs. 24 and 25 E., iron post	976.663
Corner Ts. 21 and 22 N., Rs. 23 and 24 E., iron post	1,029.203
Corner Ts. 21 and 22 N., Rs. 22 and 23 E., iron post	964.553
Closing corner T. 20 N., Rs. 22 and 23 E., iron post	1,056.473
Standard corner T. 21 N., Rs. 22 and 23 E., iron post	998.103
Closing corner T. 20 N., Rs. 23 and 24 E., iron post	1,095.003
Standard corner T. 21 N., Rs. 23 and 24 E., iron post	1,086.423
Closing corner T. 20 N., Rs. 24 and 25 E., iron post	1,139.403
Standard corner T. 21 N., Rs. 24 and 25 E., iron post	1,158.543
Closing corner T. 20 N., Rs. 25 and 26 E., iron post	1,158.065
Arkansas-Cherokee boundary line, closing corner Ts. 20 and 21 N., R. 25 E., iron post	1,137.313
Arkansas-Cherokee boundary line, closing corner Ts. 19 and 20 N., R. 26 E., iron post	1,147.027
Corner Ts. 19 and 20 N., Rs. 25 and 26 E., iron post	1,124.022
Corner Ts. 19 and 20 N., Rs. 24 and 25 E., iron post	973.993
Corner Ts. 19 and 20 N., Rs. 23 and 24 E., iron post	1,108.623
Corner Ts. 19 and 20 N., Rs. 22 and 23 E., iron post	1,105.753
Corner Ts. 18 and 19 N., Rs. 22 and 23 E., iron post	1,002.273
Corner Ts. 18 and 19 N., Rs. 23 and 24 E., iron post	1,045.231
Corner Ts. 18 and 19 N., Rs. 24 and 25 E., iron post	1,074.378
Arkansas-Cherokee boundary line, closing corner Ts. 18 and 19 N., R. 26 E., iron post	1,095.662

WINSLOW QUADRANGLE (INDIAN TERRITORY-ARKANSAS).

Levels for this small fractional quadrangle were run by Mr. J. H. Carlock, of Mr. C. W. Goodlove's party, and Mr. H. M. Tidwell, of Mr. R. H. McKee's party.

ALONG TOWNSHIP LINES.

	Feet.
Arkansas-Choctaw boundary line, closing corner Ts. 15 and 16 N., R. 26 E., iron post	1,062.238
Corner of Ts. 14 and 15 N., Rs. 26 and 27 E., iron post	1,574.13
Arkansas-Choctaw boundary line, closing corner Ts. 14 and 15 N., R. 27 E., iron post	1,581.43
Arkansas-Choctaw boundary line, closing corner Ts. 13 and 14 N., R. 27 E., iron post	1,017.74
Corner Ts. 13 and 14 N., Rs. 26 and 27 E., iron post	956
Closing corner T. 12 N., Rs. 26 and 27 E., iron post	590.308
Standard corner T. 13 N., Rs. 26 and 27 E., iron post	657.058
Arkansas-Choctaw boundary line, closing corner Ts. 12 and 13 N., R. 27 E., iron post	700.888

TAHLEQUAH QUADRANGLE.

The railroad levels were run by Messrs. E. L. Faison, W. S. D. Moore, and R. Coe. Mr. W. S. D. Moore had an independent level party. Mr. J. H. Carlock was attached to the subdivision and topographic party of Mr. C. W. Goodlove; Mr. J. P. Walker to Mr. J. Ahern's party; and Messrs. H. L. Muldrow, W. S. D. Moore, H. M. Tidwell, H. H. Hellen, and D. Hannegan ran levels for Mr. R. H. McKee's party.

FROM MARBLE, ALONG THE KANSAS CITY, PITTSBURG AND GULF RAILROAD, TO WESTVILLE.

	Feet.
Marble, 2 miles south of; intersection of railroad with third standard parallel north, R. 23 E., near railroad mile pole 283, iron post	635.527
Marble, 1 mile north of; intersection of railroad with township line, T. 13 N., Rs. 23 and 24 E., near railroad mile pole 280, iron post	639.991
Bunch, 1½ miles south of; on northwest corner of south abutment, bridge over Sallisaw Creek	734.515
Kenedy's siding, 2 miles north of; intersection of railroad with township line, Ts. 14 and 15 N., R. 24 E., 1,000 feet south of railroad mile pole 268, iron post	838.17
Stilwell; square hole cut in northeast corner of foundation stone of coal schute	1,106.048
Barren, 2 miles south of; intersection of railroad with fourth standard parallel, 45 feet west of quarter corner of sec. 34, T. 17 N., R. 25 E., 660 feet north of mile pole 252, iron post	924.316
Barren, ½ mile south of; northwest anchor bolt, on last coping stone of north abutment, bridge over Barren Fork	876.073
Westville; intersection of railroad and township line, Ts. 17 and 18 N., R. 26 E., 1,480 feet north of mile pole 245, and 1,790 feet south of Westville station, iron post	1,124.442

ALONG TOWNSHIP LINES.

	Feet.
Corner Ts. 17 and 18 N., Rs. 22 and 23 E., iron post	729.[illegible]
Corner Ts. 17 and 18 N., Rs. 23 and 24 E., iron post	1,030.[illegible]
Corner Ts. 17 and 18 N., Rs. 24 and 25 E., iron post	1,107.[illegible]
Corner Ts. 17 and 18 N., Rs. 25 and 26 E., iron post	1,123.[illegible]
Arkansas-Choctaw boundary line, closing corner Ts. 17 and 18 N., R. 26 E., iron post	1,176.[illegible]
Arkansas-Choctaw boundary line, closing corner fourth standard parallel, R. 26 E., iron post	1,119.[illegible]
Standard corner T. 17 N., Rs. 25 and 26 E., iron post	1,078.[illegible]
Closing corner T. 16 N., Rs. 25 and 26 E., iron post	1,130.7[illegible]
Standard corner T. 17 N., Rs. 24 and 25 E., iron post	1,156.445
Closing corner T. 16 N., Rs. 24 and 25 E., iron post	1,074.065
Standard corner T. 17 N., Rs. 23 and 24 E., iron post	1,085.[illegible]
Closing corner T. 16 N., Rs. 23 and 24 E., iron post	1,060.515
Standard corner T. 17 N., Rs. 22 and 23 E., iron post	892.772
Closing corner T. 16 N., Rs. 22 and 23 E., iron post	921.739
Witness corner to Ts. 15 and 16 N., Rs. 22 and 23 E., iron post	623.736
Corner Ts. 15 and 16 N., Rs. 23 and 24 E., iron post	932.496
Corner Ts. 15 and 16 N., Rs. 24 and 25 E., iron post	1,019.158
Corner Ts. 15 and 16 N., Rs. 25 and 26 E., iron post	1,111.968
Corner Ts. 14 and 15 N., Rs. 25 and 26 E., iron post	1,226.[illegible]
Corner Ts. 14 and 15 N., Rs. 24 and 25 E., iron post	1,353.76
Corner Ts. 14 and 15 N., Rs. 23 and 24 E., iron post	1,015.062
Corner Ts. 14 and 15 N., Rs. 22 and 23 E., iron post	804.762
Corner Ts. 13 and 14 N., Rs. 22 and 23 E., iron post	1,283.271
Corner Ts. 13 and 14 N., Rs. 23 and 24 E., iron post	766.501
Corner Ts. 13 and 14 N., Rs. 24 and 25 E., iron post	1,174.571
Corner Ts. 13 and 14 N., Rs. 25 and 26 E., iron post	802.851
Standard corner T. 13 N., Rs. 25 and 26 E., iron post	760.628
Closing corner T. 12 N., Rs. 25 and 26 E., iron post	694.125
Standard corner T. 13 N., Rs. 24 and 25 E., iron post	887.194
Closing corner T. 12 N., Rs. 24 and 25 E., iron post	798.308
Standard corner T. 13 N., Rs. 23 and 24 E., iron post	721.787
Closing corner T. 12 N., Rs. 23 and 24 E., iron post	639.786
Standard corner T. 13 N., Rs. 22 and 23 E., iron post	564.678
Closing corner T. 12 N., Rs. 22 and 23 E., iron post	711.482

MUSCOGEE QUADRANGLE.

The railroad levels were run by Messrs. R. Coe, G. A. Purington, A. F. Hassan, J. Phelan, and C. B. Odell. Messrs. W. S. D. Moore, C. B. Odell, A. F. Hassan, E. M. Fry, and E. L. Faison had charge of independent parties. Messrs. George Nick and J. P. Walker were attached to the subdivision and topographic party of Mr. Jeremiah Ahern, while Messrs. H. L. Muldrow, H. H. Hellen, and W. S. D. Moore were attached to that of Mr. R. H. McKee.

FROM CHECOTAH, ALONG THE MISSOURI, KANSAS AND TEXAS RAILWAY, TO WAGONER.

	Feet.
Checotah, ½ mile north of; cottonwood tree 60 feet left of line and 100 feet north of mile pole 525	637.201

	Feet.
Oktaha, 2 miles south of; copper bolt in natural ledge of stone 84.5 feet west of track and 1,815 feet south of mile pole 519; opposite old water tank foundation	551.745
Oktaha, spike in first telegraph pole south of mile pole 517	591.278
Summit, 1½ miles south of; copper bolt set 8 inches from east edge of the east coping stone of south pier, bridge 273	570.745
Summit, spike in mile pole 510	601.786
Muscogee, iron post at southeast corner of Hotel Adams lawn, 24.3 feet from railroad and 19.7 feet from hotel	599.829
Muscogee, bronze tablet in second course of stone above sidewalk of First National Bank building, left of entrance	608.618
Wybark, 1 mile south of; square hole cut into top stone on east side of ballast wall, south abutment Missouri, Kansas and Texas Railway bridge over Arkansas River	527.559
Blackstone, ½ mile north of; copper bolt sunk into coping stone of east side of south abutment of bridge over Verdigris River	518.941
Gibson station, ½ mile south of; square hole cut into west coping stone of north abutment of bridge south of mile pole 493	535.302
Wagoner, copper bolt sunk into stone, 54 feet north of the intersection of the Missouri, Kansas and Texas and St. Louis, Iron Mountain and Southern railroads	578.472

FROM ILLINOIS ALONG THE ST. LOUIS, IRON MOUNTAIN AND SOUTHERN RAILWAY TO WAGONER.

Illinois, 2 miles south of; copper bolt set into coping stone of north side of west pier of bridge over Illinois River	477.282
Illinois, 2½ miles north of; at the intersection of railroad and third standard parallel north; a sandstone post 18 by 18 by 15 inches, set between two small elm trees, which are 55.8 feet right of railroad	500.203
Braggs, 3 miles south of; nail in post oak tree 24 inches, 45 feet right of railroad	494.454
Braggs, 3 miles north of; copper bolt set into third coping stone of north end of east pier of bridge 104, which is 700 feet west of mile pole 567	502.315
Fort Gibson, 2½ miles south of; square hole cut into second coping stone of east pier of bridge 106 over Bayou Manard	510.732
Fort Gibson, 1 mile north of; copper bolt set into third coping stone of east pier of bridge over Grand River	515.515
Corretta, 1 mile south of; nail in post oak 12 inches in diameter, 75 feet right of track, 300 feet east of mile pole 579	550.334
Corretta, 1 mile north of; red oak 20 inches in diameter, 75 feet right of track, 90 feet north of mile pole 581	515.528
Wagoner, bronze tablet set into first course of stone, 2½ feet above sidewalk, and 8 inches from south corner of First National Bank Building	588.436

ALONG TOWNSHIP LINES.

Corner Ts. 17 and 18 N., Rs. 17 and 18 E., iron post	555.162
Corner Ts. 17 and 18 N., Rs. 18 and 19 E., iron post	545.261
Corner Ts. 17 and 18 N., Rs. 19 and 20 E., iron post	691.926
Corner Ts. 17 and 18 N., Rs. 20 and 21 E., iron post	676.141
Corner Ts. 17 and 18 N., Rs. 21 and 22 E., iron post	928.561
Standard corner T. 17 N., Rs. 21 and 22 E., iron post	798.569
Closing corner T. 16 N., Rs. 21 and 22 E., iron post	814.089
Standard corner T. 17 N., Rs. 20 and 21 E., iron post	811.423

	Feet.
Closing corner T. 16 N., Rs. 20 and 21 E., iron post	756.873
Standard corner T. 17 N., Rs. 19 and 20 E., iron post	679.989
Standard corner T. 17 N., Rs. 18 and 19 E., iron post	565.105
Standard corner T. 17 N., 17 and 18 E., iron post	513.175
Corner Ts. 15 and 16 N., Rs. 17 and 18 E., iron post	608.222
Corner Ts. 15 and 16 N., Rs. 18 and 19 E., iron post	515.2
Corner Ts. 15 and 16 N., Rs. 19 and 20 E., iron post	601.499
Corner Ts. 15 and 16 N., Rs. 20 and 21 E., iron post	666.365
Corner Ts. 15 and 16 N., Rs. 21 and 22 E., iron post	832.446
Corner Ts. 14 and 15 N., Rs. 21 and 22 E., iron post	768.502
Corner Ts. 14 and 15 N., Rs. 20 and 21 E., iron post	660.562
Corner Ts. 14 and 15 N., Rs. 18 and 19 E., iron post	560.153
Corner Ts. 14 and 15 N., Rs. 17 and 18 E., iron post	626.221
Corner Ts. 13 and 14 N., Rs. 17 and 18 E., iron post	612.197
Corner Ts. 13 and 14 N., Rs. 18 and 19 E., iron post	570.197
Corner Ts. 13 and 14 N., Rs. 20 and 21 E., iron post	776.775
Corner Ts. 13 and 14 N., Rs. 21 and 22 E., iron post	527.225
Standard corner T. 13 N., Rs. 21 and 22 E., iron post	828.097
Closing corner T. 12 N., Rs. 21 and 22 E., iron post	799.963
Standard corner T. 13 N., Rs. 20 and 21 E., iron post	613.945
Closing corner T. 12 N., Rs. 20 and 21 E., iron post	504.083
Standard corner T. 13 N., Rs. 19 and 20 E., iron post	533.045
Closing corner T. 12 N., Rs. 19 and 20 E., iron post	544.099
Standard corner T. 13 N., Rs. 18 and 19 E., iron post	510.016
Closing corner T. 12 N., Rs. 18 and 19 E., iron post	512.755
Standard corner T. 13 N., Rs. 17 and 18 E., iron post	708.645
Closing corner T. 12 N., Rs. 17 and 18 E., iron post	733.745

OKMULGEE QUADRANGLE.

No railroad levels were run in this quadrangle. Messrs. W. S. D. Moore, C. B. Odell, A. F. Hassan, E. M. Fry, E. H. Lonsdale, and E. L. Faison had charge of independent level parties.

ALONG TOWNSHIP LINES.

	Feet.
Corner Ts. 17 and 18 N., Rs. 12 and 13 E., iron post	720.067
Corner Ts. 17 and 18 N., Rs. 13 and 14 E., iron post	618.257
Corner Ts. 17 and 18 N., Rs. 14 and 15 E., iron post	629.297
Corner Ts. 17 and 18 N., Rs. 15 and 16 E., iron post	723.357
Corner Ts. 17 and 18 N., Rs. 16 and 17 E., iron post	524.007
Standard corner T. 17 N., Rs. 16 and 17 E., iron post	604.495
Standard corner T. 17 N., Rs. 15 and 16 E., iron post	565.459
Standard corner T. 17 N., Rs. 14 and 15 E., iron post	704.2
Standard corner T. 17 N., Rs. 13 and 14 E., iron post	597.175
Standard corner T. 17 N., Rs. 12 and 13 E., iron post	711.175
Corner Ts. 15 and 16 N., Rs. 12 and 13 E., iron post	716.168
Corner Ts. 15 and 16 N., Rs. 13 and 14 E., iron post	654.172
Corner Ts. 15 and 16 N., Rs. 14 and 15 E., iron post	670.174
Corner Ts. 15 and 16 N., Rs. 15 and 16 E., iron post	562.187
Corner Ts. 15 and 16 N., Rs. 16 and 17 E., iron post	567.268
Corner Ts. 14 and 15 N., Rs. 16 and 17 E., iron post	650.174
Corner Ts. 14 and 15 N., Rs. 15 and 16 E., iron post	607.19
Corner Ts. 14 and 15 N., Rs. 14 and 15 E., iron post	671.174
Corner Ts. 14 and 15 N., Rs. 13 and 14 E., iron post	768.188

	Feet.
Corner Ts. 14 and 15 N., Rs. 12 and 13 E., iron post	885.166
Corner Ts. 13 and 14 N., Rs. 12 and 13 E., iron post	678.227
Corner Ts. 13 and 14 N., Rs. 13 and 14 E., iron post	698.195
Corner Ts. 13 and 14 N., Rs. 14 and 15 E., iron post	658.198
Corner Ts. 13 and 14 N., Rs. 15 and 16 E., iron post	635.197
Corner Ts. 13 and 14 N., Rs. 16 and 17 E., iron post	680.855
Standard corner T. 13 N., Rs. 16 and 17 E., iron post	611.863
Closing corner T. 12 N., Rs. 16 and 17 E., iron post	616.846
Standard corner T. 13 N., Rs. 15 and 16 E., iron post	644.858
Closing corner T. 12 N., Rs. 15 and 16 E., iron post	639.823
Standard corner T. 13 N., Rs. 14 and 15 E., iron post	805.861
Closing corner T. 12 N., Rs. 14 and 15 E., iron post	742.85
Standard corner T. 13 N., Rs. 13 and 14 E., iron post	660.86
Closing corner T. 12 N., Rs. 13 and 14 E., iron post	648.866
Standard corner T. 13 N., Rs. 12 and 13 E., iron post	789.952
Closing corner T. 12 N., Rs. 12 and 13 E., iron post	807.215

NUYAKA QUADRANGLE.

The levels in this quadrangle were run by several independent parties under Messrs. W. S. D. Moore, W. R. Manning, A. F. Hassan, E. M. Fry, E. L. Faison, C. B. Odell, and E. H. Lonsdale.

ALONG TOWNSHIP LINES.

	Feet.
Corner Ts. 17 and 18 N., Rs. 8 and 9 E., iron post	831.885
Corner Ts. 17 and 18 N., Rs. 11 and 12 E., iron post	649.175
Standard corner T. 17 N., Rs. 11 and 12 E., iron post	881.175
Closing corner T. 16 N., Rs. 11 and 12 E., iron post	843.027
Standard corner T. 17 N., Rs. 10 and 11 E., iron post	767.137
Closing corner T. 16 N., Rs. 10 and 11 E., iron post	699.285
Closing corner T. 16 N., Rs. 9 and 10 E., iron post	758.305
Standard corner T. 17 N., Rs. 8 and 9 E., iron post	923.309
Corner Ts. 15 and 16 N., Rs. 8 and 9 E., iron post	780.763
Corner Ts. 15 and 16 N., Rs. 9 and 10 E., iron post	757.385
Corner Ts. 15 and 16 N., Rs. 10 and 11 E., iron post	969.152
Corner Ts. 15 and 16 N., Rs. 11 and 12 E., iron post	792.165
Corner Ts. 14 and 15 N., Rs. 11 and 12 E., iron post	831.169
Corner Ts. 14 and 15 N., Rs. 10 and 11 E., iron post	726.351
Corner Ts. 14 and 15 N., Rs. 9 and 10 E., iron post	798.297
Corner Ts. 14 and 15 N., Rs. 8 and 9 E., iron post	845.11
Corner Ts. 13 and 14 N., Rs. 8 and 9 E., iron post	717.728
Corner Ts. 13 and 14 N., Rs. 9 and 10 E., iron post	756.488
Corner Ts. 13 and 14 N., Rs. 10 and 11 E., iron post	673.398
Corner Ts. 13 and 14 N., Rs. 11 and 12 E., iron post	869.598
Standard corner T. 13 N., Rs. 11 and 12 E., iron post	841.561
Standard corner T. 13 N., Rs. 10 and 11 E., iron post	748.85
Standard corner T. 13 N., Rs. 9 and 10 E., iron post	782.842
Standard corner T. 13 N., Rs. 8 and 9 E., iron post	876.842

WEWOKA QUADRANGLE.

The railroad levels were run by Mr. E. L. Faison. Messrs. W. S. D. Moore, W. R. Manning, and E. L. Faison had independent level parties.

FROM HOLDENVILLE, ALONG THE CHOCTAW, OKLAHOMA AND GULF RAILROAD, TO WEWOKA.

	Feet.
Holdenville, 5 miles east of; square hole cut in large stone 30 feet south of track and 35 feet east of trestle No. 154	813.659
Holdenville; iron post at northwest corner of platform, 75 feet west of station building and 15 feet north of track	862.744
Wewoka; iron post south of track, 5 feet east of mile pole No, 99 and 2,400 feet west of station building	786.277

ALONG TOWNSHIP LINES.

Corner Ts. 11 and 12 N., Rs. 8 and 9 E., iron post	896.074
Corner Ts. 11 and 12 N., Rs. 9 and 10 E., iron post	903.553
Corner Ts. 11 and 12 N., Rs. 10 and 11 E., iron post	889.942
Corner Ts. 11 and 12 N., Rs. 11 and 12 E., iron post	716.135
Corner Ts. 10 and 11 N., Rs. 11 and 12 E., iron post	726.32
Corner Ts. 10 and 11 N., Rs. 10 and 11 E., iron post	893.388
Corner Ts. 10 and 11 N., Rs. 9 and 10 E., iron post	855.052
Corner Ts. 10 and 11 N., Rs. 8 and 9 E., iron post	826.052
Corner Ts. 9 and 10 N., Rs. 8 and 9 E., iron post	846.839
Corner Ts. 9 and 10 N., Rs. 9 and 10 E., iron post	855.906
Corner Ts. 9 and 10 N., Rs. 10 and 11 E., iron post	748.966
Corner Ts. 9 and 10 N., Rs. 11 and 12 E., iron post	733.106
Standard corner, T. 9 N., Rs. 11 and 12 E., iron post	832.855
Standard corner, T. 9 N., Rs. 10 and 11 E., iron post	787.233
Standard corner, T. 9 N., Rs. 9 and 10 E., iron post	734.165
Standard corner, T. 9 N., Rs. 8 and 9 E., iron post	847.189
Corner Ts. 7 and 8 N., Rs 8 and 9 E., iron post	798.729
Corner Ts. 7 and 8 N., Rs. 9 and 10 E., iron post	866.892
Corner Ts. 7 and 8 N., Rs. 10 and 11 E., iron post	921.165
Corner Ts. 7 and 8 N., Rs. 11 and 12 E., iron post	811.812
Corner Ts. 6 and 7 N., Rs. 11 and 12 E., iron post	854.793
Corner Ts. 6 and 7 N., Rs. 10 and 11 E., iron post	827.787
Corner Ts. 6 and 7 N., Rs. 9 and 10 E., iron post	800.811
Corner Ts. 6 and 7 N., Rs. 8 and 9 E., iron post	752.823

CANADIAN QUADRANGLE.

The railroad levels were run by Mr. G. A. Purington. Messrs. E. L. Faison, W. R. Manning, and W. S. D. Moore had independent level parties. Messrs. George Nick and J. P. Walker were attached to the topographic and subdivision party of Mr. Jeremiah Ahern, while Messrs. Moore and Purington were attached for a short time to that of Mr. W. B. Corse.

FROM M'ALESTER, ALONG THE MISSOURI, KANSAS AND TEXAS RAILWAY, TO CHECOTAH.

	Feet.
McAlester, 3 miles north of; nail in post oak 36 inches in diameter, 50 feet right of track and 1,100 feet south of mile pole 561	623.557
Reams, ½ mile south of; copper bolt sunk into first coping stone of northeast abutment of trestle 317, 3,000 feet north of mile pole 556	612.067
Reams; on "head block" of north end of siding	595.3

	Feet.
Reams, 5 miles north of; copper bolt set into stone on northeast abutment, north end of trestle 310, which is the first trestle south of mile pole 550..	609.022
South Canadian, ¼ mile north of; nail in root of black jack oak, 24 inches in diameter, 60 feet left of track and 60 feet north of mile pole 547.....	654.873
South Canadian, 3⅜ miles north of; copper bolt set into first coping stone of northwest abutment bridge 304, which spans the South Canadian River.	556.558
Eufaula; 1,000 feet north of station building, red oak, 12 inches in diameter, 50 feet left of track and 140 feet north of mile pole 538................	617.219
Eufaula, 2 miles north of; copper bolt set into first coping stone on northwest abutment of bridge 298, which spans the North Canadian River ..	549.439
Bond; copper bolt set into stone on northwest side of stone culvert, north of section house 75 and 90 feet north of switch	661.031
Checotah, ⅓ mile south of; nail in cottonwood tree 60 feet left of track and 100 feet north of mile pole 525.....................................	637.201

ALONG TOWNSHIP LINES.

Corner Ts. 11 and 12 N., Rs. 12 and 13 E., iron post......................	872.835
Corner Ts. 11 and 12 N., Rs. 13 and 14 E., iron post......................	593.88
Corner Ts. 11 and 12 N., Rs. 14 and 15 E., iron post......................	757.826
Corner Ts. 11 and 12 N., Rs. 15 and 16 E., iron post......................	659.538
Corner Ts. 11 and 12 N., Rs. 16 and 17 E., iron post......................	640.989
Corner Ts. 10 and 11 N., Rs. 16 and 17 E., iron post......................	629.512
Corner Ts. 10 and 11 N., Rs. 15 and 16 E., iron post......................	608.978
Corner Ts. 10 and 11 N., Rs. 14 and 15 E., iron post......................	631.342
Corner Ts. 10 and 11 N., Rs. 13 and 14 E., iron post......................	663.469
Corner Ts. 10 and 11 N., Rs. 12 and 13 E., iron post......................	735.478
Corner Ts. 9 and 10 N., Rs. 12 and 13 E., iron post........................	803.885
Corner Ts. 9 and 10 N., Rs. 13 and 14 E., iron post........................	715.269
Corner Ts. 9 and 10 N., Rs. 14 and 15 E., iron post........................	672.545
Corner Ts. 9 and 10 N., Rs. 15 and 16 E., iron post........................	630.256
Corner Ts. 9 and 10 N., Rs. 16 and 17 E., iron post........................	565.803
Standard corner T. 9 N., Rs. 16 and 17 E., iron post......................	562.048
Standard corner T. 9 N., Rs. 15 and 16 E., iron post......................	604.909
Standard corner T. 9 N., Rs. 14 and 15 E., iron post......................	675.827
Standard corner T. 9 N., Rs. 13 and 14 E., iron post......................	694.866
Standard corner T. 9 N., Rs. 12 and 13 E., iron post......................	720.91
Corner Ts. 7 and 8 N., Rs. 12 and 13 E., iron post..........................	838.844
Corner Ts. 7 and 8 N., Rs. 13 and 14 E., iron post..........................	702.795
Corner Ts. 7 and 8 N., Rs. 14 and 15 E., iron post..........................	651.81
Corner Ts. 7 and 8 N., Rs. 15 and 16 E., iron post..........................	717.276
Corner Ts. 7 and 8 N., Rs. 16 and 17 E., iron post..........................	760.818
Corner Ts. 6 and 7 N., Rs. 16 and 17 E., iron post..........................	761.818
Corner Ts. 6 and 7 N., Rs. 15 and 16 E., iron post..........................	557.947
Corner Ts. 6 and 7 N., Rs. 14 and 15 E., iron post..........................	880.861
Corner Ts. 6 and 7 N., Rs. 13 and 14 E., iron post..........................	657.959
Corner Ts. 6 and 7 N., Rs. 12 and 13 E., iron post..........................	766.841

SANSBOIS QUADRANGLE.

No levels were run by railroad or independent parties. Messrs. G. A. Purington and W. S. D. Moore were attached to the subdivision and topographic party of Mr. W. B. Corse (relieved by Mr. Farmer), and Messrs. George Nick and J. P. Walker to Mr. J. Ahern's party.

ALONG TOWNSHIP LINES.

	Feet
Corner Ts. 11 and 12 N., Rs. 17 and 18 E., iron post	656.97
Corner Ts. 11 and 12 N., Rs. 18 and 19 E., iron post	588.44
Corner Ts. 11 and 12 N., Rs. 19 and 20 E., iron post	557.62
Corner Ts. 11 and 12 N., Rs. 20 and 21 E., iron post	470.948
Corner Ts. 11 and 12 N., Rs. 21 and 22 E., iron post	518.914
Corner Ts. 10 and 11 N., Rs. 21 and 22 E., iron post	560.5
Corner Ts. 10 and 11 N., Rs. 20 and 21 E., iron post	468.541
Corner Ts. 10 and 11 N., Rs. 19 and 20 E., iron post	560.514
Corner Ts. 10 and 11 N., Rs. 18 and 19 E., iron post	872.38
Corner Ts. 10 and 11 N., Rs. 17 and 18 E., iron post	586.11
Corner Ts. 9 and 10 N., Rs. 17 and 18 E., iron post	871.58
Corner Ts. 9 and 10 N., Rs. 18 and 19 E., iron post	815.035
Corner Ts. 9 and 10 N., Rs. 19 and 20 E., iron post	516.592
Corner Ts. 9 and 10 N., Rs. 20 and 21 E., iron post	541.781
Corner Ts. 9 and 10 N., Rs. 21 and 22 E., iron post	605.42
Standard corner T. 9 N., Rs. 21 and 22 E., iron post	473.754
Closing corner T. 8 N., Rs. 21 and 22 E., iron post	477.854
Standard corner T. 9 N., Rs. 20 and 21 E., iron post	682.274
Closing corner T. 8 N., Rs. 20 and 21 E., iron post	706.724
Standard corner T. 9 N., Rs. 19 and 20 E., iron post	627.104
Closing corner T. 8 N., Rs. 19 and 20 E., iron post	655.434
Standard corner T. 9 N., Rs. 18 and 19 E., iron post	901.987
Closing corner T. 8 N., Rs. 18 and 19 E., iron post	937.289
Standard corner T. 9 N., Rs. 17 and 18 E., iron post	834.587
Closing corner T. 8 N., Rs. 17 and 18 E., iron post	840.344
Corner Ts. 7 and 8 N., Rs. 17 and 18 E., iron post	915.597
Corner Ts. 7 and 8 N., Rs. 18 and 19 E., iron post	616.317
Corner Ts. 7 and 8 N., Rs. 19 and 20 E., iron post	532.857
Corner Ts. 7 and 8 N., Rs. 20 and 21 E., iron post	620.677
Corner Ts. 7 and 8 N., Rs. 21 and 22 E., iron post	602.797
Corner Ts. 6 and 7 N., Rs. 21 and 22 E., iron post	801.106
Corner Ts. 6 and 7 N., Rs. 20 and 21 E., iron post	831.526
Corner Ts. 6 and 7 N., Rs. 19 and 20 E., iron post	948.666
Corner Ts. 6 and 7 N., Rs. 18 and 19 E., iron post	1,293.066
Corner Ts. 6 and 7 N., Rs. 17 and 18 E., iron post	900.81

SALLISAW QUADRANGLE.

The railroad levels were run by Messrs. R. Coe, G. A. Purington, E. L. Faison, E. M. Fry, C. H. Hickman, and J. W. Phelan. Mr. J. H. Carlock was attached to the subdivision and topographic party of Mr. C. W. Goodlove; Messrs. J. P. Walker and D. Voorhees to that of Mr. J. Ahern, and Messrs. E. M. Fry and G. A. Purington to that of Mr. R. A. Farmer.

FROM SALLISAW, ALONG THE KANSAS CITY, PITTSBURG AND GULF RAILROAD, TO POTEAU.

	Feet.
Sallisaw; iron post set at south end of platform, east of track, at Kansas City, Pittsburg and Gulf Railroad station	524.251
Sallisaw, 4 miles south of; intersection of railroad with sixth guide meridian east; iron post set in line of telegraph poles, 3,000 feet north of mile pole 295	567.102

	Feet.
Gans, ½ mile south of; the intersection of railroad with township line, Ts. 10 and 11 N., R. 25 E.; iron post set in line of telegraph poles, 35 feet west of track	481.56
Redland, ½ mile south of; intersection of railroad with township line, Ts. 9 and 10 N., R. 25 E., iron post 15 feet west of track	430.633
Oak Lodge, 2½ miles south of; intersection of railroad with second standard parallel north, R. 25 E., spike in white oak (blazed and marked), 50 feet west of track	474.72
Shady Point, ½ mile south of; intersection of township line, Ts. 7 and 8 N., R. 25 E., 100 feet south of mile pole 321, and 60 feet west of track; iron post	427.565
Poteau; iron post set at south end of station platform, 36 feet west of main track	457.005
Poteau, 1¾ miles south of; intersection of railroad with township line, Ts. 6 and 7 N., R. 25 E.; water oak, 60 feet west of track	441.805

FROM CAMERON, ALONG THE ST. LOUIS AND SAN FRANCISCO RAILROAD, TO POTEAU.

Cameron; copper bolt in stone monument 57 feet east of track and 60 feet north of station building. Monument is referenced by a stone 12 feet north and one 12 feet east	487.591
Cameron; bronze tablet set into fifth stone above foundation course at southeast corner of building owned by Mrs. F. H. Carr, and used as a general store and post-office building, is 170 feet west of the St. Louis and San Francisco track, and 27 feet south of a prolonged line of the south end of the station building	487.518
Cameron, 5 miles south of; hickory tree 12 inches in diameter, 60 feet left of track and 260 feet north of mile pole 441	445.479
Poteau, 2 miles south of; "twin" post oak, 70 feet right of track and 800 feet south of mile pole 447	505.496

FROM CHEROKEE, ALONG THE ST. LOUIS, IRON MOUNTAIN AND SOUTHERN RAILWAY, TO VIAN.

Cherokee, 5 miles west of; at bridge 26, spike in black oak, 15 inches in diameter, 70 feet left of track	480.746
Muldrow; sandstone post, 2 by 6 by 6 inches, marked B + M, buried 6 inches below surface, 71.3 feet from northeast corner of station building and 30 feet from "mail grab"	510.846
Hanson; spike in red oak 4 inches in diameter, 100 feet left of track	568.741
Sallisaw; sandstone post, 2 by 8 by 5 inches, marked $\overset{\text{U.S.G.S.}}{\text{B + M}}$, buried south of station building, 40.6 feet from southeast and 44.8 feet from southwest corners of same	530.188
McKey, spike in red oak 8 inches in diameter, 60 feet right of track	536.086
Vian; sandstone post, 28 by 8 by 4 inches, marked $\overset{\text{U.S.G.S.}}{\text{B + M}}$, buried 6 inches beneath the surface, south of station building, 31 7 feet from southwest and 36.7 feet from southeast corners of same	545.598

ALONG TOWNSHIP LINES.

Corner Ts. 11 and 12 N., Rs. 22 and 23 E., iron post	478.108
Corner Ts. 11 and 12 N., Rs. 23 and 24 E., iron post	550.394
Corner Ts. 11 and 12 N., Rs. 24 and 25 E., iron post	532.658

	Feet
Corner Ts. 11 and 12 N., Rs. 25 and 26 E., iron post	684.996
Corner Ts. 10 and 11 N., Rs. 25 and 26 E., iron post	477.675
Corner Ts. 10 and 11 N., Rs. 24 and 25 E., iron post	564.86
Corner Ts. 10 and 11 N., Rs. 23 and 24 E., iron post	494.965
Corner Ts. 10 and 11 N., Rs. 22 and 23 E., iron post	445.625
Corner Ts. 9 and 10 N., Rs. 22 and 23 E., iron post	458.547
Corner Ts. 9 and 10 N., Rs. 23 and 24 E., iron post	603.999
Corner Ts. 9 and 10 N., Rs. 24 and 25 E., iron post	440.093
Corner Ts. 9 and 10 N., Rs. 25 and 26 E., iron post	423.723
Closing corner T. 8 N., Rs. 26 and 27 E., iron post	622.37
Standard corner T. 9 N., Rs. 25 and 26 E., iron post	437.53
Closing corner T. 8 N., Rs. 25 and 26 E., iron post	440.51
Standard corner T. 9 N., Rs. 24 and 25 E., iron post	570.324
Closing corner T. 8 N., Rs. 24 and 25 E., iron post	562.334
Standard corner T. 9 N., Rs. 23 and 24 E., iron post	553.614
Closing corner T. 8 N., Rs. 23 and 24 E., iron post	540.374
Standard corner T. 9 N., Rs. 22 and 23 E., iron post	693.454
Closing corner T. 8 N., Rs. 22 and 23 E., iron post	633.544
Corner Ts. 7 and 8 N., Rs. 22 and 23 E., iron post	655.747
Corner Ts. 7 and 8 N., Rs. 23 and 24 E., iron post	466.057
Corner Ts. 7 and 8 N., Rs. 24 and 25 E., iron post	519.767
Corner Ts. 7 and 8 N., Rs. 25 and 26 E., iron post	424.187
Corner Ts. 7 and 8 N., Rs. 26 and 27 E., iron post	521.032
Corner Ts. 6 and 7 N., Rs. 26 and 27 E., iron post	583.406
Corner Ts. 6 and 7 N., Rs. 25 and 26 E., iron post	443.266
Corner Ts. 6 and 7 N., Rs. 24 and 25 E., iron post	711.136
Corner Ts. 6 and 7 N., Rs. 23 and 24 E., iron post	1,287.856
Corner Ts. 6 and 7 N., Rs. 22 and 23 E., iron post	511.336

FORT SMITH QUADRANGLE (INDIAN TERRITORY-ARKANSAS).

The railroad levels were run by Messrs. R. Coe, C. H. Hickman, J. Phelan, and G. A. Purington. Mr. J. H. Carlock was attached to the subdivision and topographic party of Mr. C. W. Goodlove, and Mr. E. M. Fry to that of Mr. R. A. Farmer.

FROM FORT SMITH, ARKANSAS, ALONG THE ST. LOUIS AND SAN FRANCISCO RAILROAD, TO JENSON, ARKANSAS.

	Feet.
Fort Smith, Arkansas (bench mark established by United States Coast and Geodetic Survey); a copper bolt leaded in the west wall of United States jail (brick). The bolt is in the first course above the limestone base stone and about 1 meter above the ground. It is in the fifth brick from the panel formed by the side of the building and the brick ventilator. The jail is a new pressed-brick addition to the old United States building. A cross was cut in the end of the bolt, and the intersection of the lines forming the cross is the bench mark. The letters U. S. B. M. were in the base stone immediately below the bolt	446.29
Fort Smith, Arkansas, 5 miles south of; black oak 65 feet to the right of track and 190 feet north of milepole 420	478.696
Cedars, Indian Territory; elm 12 inches in diameter 45 feet left and 75 feet south of milepole 424	448.044
Jenson, Arkansas; square hole drilled into the north veranda post stone of stone building just back of station, which has been destroyed by fire	545.11
Jenson, 4 miles south of; water oak 50 feet left of track and nearly opposite milepole 433	452.629

ALONG TOWNSHIP LINES.

	Feet.
Corner Ts. 11 and 12 N., Rs. 26 and 27 E., iron post	723.718
Arkansas-Choctaw boundary line, closing corner Ts. 11 and 12 N., R. 27 E., iron post	764.098
Arkansas-Choctaw boundary line, closing corner Ts. 10 and 11 N., R. 27 E., iron post	435.875
Corner Ts. 10 and 11 N., Rs. 26 and 27 E., iron post	418.425
Corner Ts. 9 and 10 N., Rs. 26 and 27 E., iron post	421.073
Arkansas-Choctaw boundary line, closing corner Ts. 9 and 10 N., R. 27 E., iron post	513.2
Arkansas boundary line. closing corner second standard parallel north, R. 27 E., iron post	555.16
Standard corner T. 9 N., Rs. 26 and 27 E., iron post	620.01
Arkansas-Choctaw boundary line, closing corner Ts. 7 and 8 N., R. 27 E., iron post	611.302
Arkansas-Choctaw boundary line, closing corner Ts. 6 and 7 N., R. 27 E., iron post	1,388.956

POTEAU MOUNTAIN QUADRANGLE (ARKANSAS-INDIAN TERRITORY).

Mr. E. M. Fry ran the railroad levels. Mr. W. P. Halliday was attached to the subdivision and topographic party of Mr. W. S. Post, and Mr. E. M. Fry to Mr. R. A. Farmer's party.

ON KANSAS CITY, PITTSBURG AND GULF RAILROAD.

	Feet.
Page, 5 miles south of; intersection of railroad with Arkansas-Choctaw boundary line, iron post	1,223.405

ALONG TOWNSHIP LINES.

Arkansas-Choctaw boundary line, closing corner Ts. 5 and 6 N., R. 27 E., iron post	1,615.97
Arkansas-Choctaw boundary line, closing corner Ts. 4 and 5 N., R. 27 E., corner stone	690.164
Arkansas-Choctaw boundary line, closing corner Ts. 1 N. and 1 S., R. 27 E., corner stone	948.219

WINDING STAIR QUADRANGLE.

Messrs. R. Coe, G. A. Purington, H. C. McCluer, and E. M. Fry ran the railroad levels. Mr. F. E. Fellows had an independent level party. Messrs. G. A. Purington and E. M. Fry were attached to the topographic and subdivision party of Mr. R. A. Farmer, and Messrs. W. P. Halliday and G. H. Bartlett to that of Mr. W. S. Post.

ALONG THE CHOCTAW, OKLAHOMA AND GULF RAILROAD, FROM WISTER TO FANSHAWE.

	Feet.
Wister; post oak, 24 inches in diameter, in the northeast angle of the Choctaw, Oklahoma and Gulf, and the St. Louis and San Francisco railroads, 150 feet from the Choctaw, Oklahoma and Gulf, and 350 feet from the St. Louis and San Francisco track	474.072

	Feet.
Wister, ½ mile west of; square hole in south coping stone of east abutment of bridge No. 1	480.9
Wister, 1½ miles west of; square hole in north coping stone of east abutment of bridge No. 7, 500 feet west of milepost 214	497.2
Fanshawe, 2 miles east of; square hole in north coping stone of east abutment of bridge near milepost 207	553.5
Fanshawe, ½ mile west of; red oak, 16 inches in diameter, 120 feet right of track and 100 feet west of milepost 205	554.48
Fanshawe, 3 miles west of; elm, 18 inches in diameter, 130 feet right and 200 feet west of milepost 202	543.94

ALONG THE ST. LOUIS AND SAN FRANCISCO RAILROAD FROM CAVANAL TO LEFLORE.

Cavanal; post oak, 24 inches in diameter, 180 feet left of track, nearly opposite milepost 451	468.9
Wister, ½ mile west of; square hole cut into south coping stone of east pier of bridge 237 T	472.701
Wister, 1 mile southwest of; black oak, 8 inches in diameter, 150 feet south and 75 feet east of milepost 454	478.153
Caston; white oak, 30 inches in diameter, 60 feet right of track, opposite milepost 456	494.889
Pocahontas; red oak, 20 inches in diameter, 120 feet north and 100 west of milepost 458	562.022
Folsom; white oak 16 inches in diameter, 100 feet south of track, opposite milepost 463	490.631
Leflore; elm 10 inches in diameter, 90 feet south and 100 feet east of station building	532.477

ALONG THE KANSAS CITY, PITTSBURG AND GULF RAILROAD FROM HEAVENER TO PAGE.

Heavener, 2 miles north of; at the intersection of the railroad with the north boundary of T. 5 N., R. 25 E., iron post	512.224
Heavener, 1 mile north of; copper bolt set into east coping stone of north abutment bridge over drain	565.278
Heavener, 1 mile south of; 650 feet south of milepost 338, iron post	553.226
Houston, 3 miles north of; at the intersection of the railroad with the first standard parallel north, near milepost 342, iron post	504.338
Houston, ½ mile south of; copper bolt set into east coping stone of north abutment bridge over drain	540.341
Thomasville, ½ mile south of; copper bolt set into west coping stone of north abutment bridge over creek	656.966
Page, ½ mile south of; root of a basswood 16 inches in diameter and 60 feet west of track and 35 feet south of mile-pole 355	927.355

ALONG TOWNSHIP LINES.

Corner Ts. 5 and 6 N., Rs. 26 and 27 E., iron post	980.967
Corner Ts. 5 and 6 N., Rs. 25 and 26 E., iron post	499.297
Corner Ts. 5 and 6 N., Rs. 24 and 25 E., iron post	456.937
Corner Ts. 5 and 6 N., Rs. 23 and 24 E., iron post	521.117
Corner Ts. 5 and 6 N., Rs. 22 and 23 E., iron post	551.271
Closing corner T. 4 N., Rs. 22 and 23 E., on stone	913.544
Standard corner T. 5 N., Rs. 22 and 23 E., iron post	722.694
ing corner T. 4 N., Rs. 23 and 24 E., iron post	586.036

	Feet
Standard corner T. 5 N., Rs. 23 and 24 E., on stone	640.234
Closing corner T. 4 N., Rs. 24 and 25 E., on stone	575.924
Standard corner T. 5 N., Rs. 24 and 25 E., iron post	541.044
Closing corner T. 4 N., Rs. 25 and 26 E., iron post	507.544
Standard corner T. 5 N., Rs. 25 and 26 E., iron post	503.334
Closing corner T. 4 N., Rs. 26 and 27 E., iron post	566.264
Standard corner T. 5 N., Rs. 26 and 27 E., iron post	577.884
Corner Ts. 3 and 4 N., Rs. 26 and 27 E., iron post	703.372
Corner Ts. 3 and 4 N., Rs. 25 and 26 E., iron post	598.842
Corner Ts. 3 and 4 N., Rs. 24 and 25 E., iron post	951.786
Corner Ts. 3 and 4 N., Rs. 23 and 24 E., iron post	1,172.571
Corner Ts. 3 and 4 N., Rs. 22 and 23 E., iron post	1,023.659
Corner Ts. 2 and 3 N., Rs. 22 and 23 E., iron post	641.008
Corner Ts. 2 and 3 N., Rs. 23 and 24 E., iron post	686.451
Corner Ts. 2 and 3 N., Rs. 24 and 25 E., iron post	910.872
Corner Ts. 2 and 3 N., Rs. 25 and 26 E., iron post	2,471.012
Corner Ts. 2 and 3 N., Rs. 26 and 27 E., iron post	1,271.821
Corner Ts. 1 and 2 N., Rs. 26 and 27 E., iron post	1,977.796
Corner Ts. 1 and 2 N., Rs. 25 and 26 E., iron post	1,922.366
Corner Ts. 1 and 2 N., Rs. 24 and 25 E., iron post	1,478.558
Corner Ts. 1 and 2 N., Rs. 23 and 24 E., iron post	1,279.457
Corner Ts. 1 and 2 N., Rs. 22 and 23 E., iron post	1,344.108
Closing corner T. 1 S., Rs. 22 and 23 E., iron post	1,394.063
Standard corner T. 1 N., Rs. 22 and 23 E., iron post	1,382.122
Closing corner T. 1 S., Rs. 23 and 24 E., iron post	1,635.612
Standard corner T. 1 N., Rs. 23 and 24 E., iron post	1,756.266
Triangulation station, base line, sec. 31, T. 1 N., R. 24 E., near southwest corner of the SW. ¼, white oak 10 inches diameter, same having been used as signal tree	1,989.063
Closing corner T. 1 S., Rs. 24 and 25 E., iron post	888.039
Standard corner T. 1 N., Rs. 24 and 25 E., iron post	874.773
Closing corner T. 1 S., Rs. 25 and 26 E., iron post	866.809
Standard corner T. 1 N., Rs. 25 and 26 E., on stone	896.989
Closing corner T. 1 S., Rs. 26 and 27 E., iron post	940.459
Standard corner T. 1 N., Rs. 26 and 27 E., on stone	904.129

TUSKAHOMA QUADRANGLE.

Messrs. R. Coe, H. C. McCluer, and G. A. Purington ran the railroad levels. Messrs. E. L. Faison and F. E. Fellows had independent level parties. Messrs. W. P. Halliday and G. H. Bartlett were attached to the topographic and subdivision party of Mr. W. S. Post, and Messrs. W. A. Correll, C. Doster, W. S. D. Moore, G. A. Purington, and E. M. Fry to the party of Mr. G. S. Smith, who was relieved by Mr. W. B. Corse, and he by Mr. R. A. Farmer.

ALONG THE ST. LOUIS AND SAN FRANCISCO RAILROAD FROM BENGAL TO STANLEY.

	Feet.
Bengal, ⅓ mile northeast of; red oak 15 inches diameter, 60 feet left of track and 210 feet south of milepost 475	626.67
Compton, ¾ mile southwest of; near top of west end of north abutment of bridge 286, copper bolt	906.631

	Feet
Talihina; black gum 10 inches diameter, 60 feet left of track and 100 feet south of milepost 484	673.947
Albion; post oak 20 inches diameter, 60 feet left of track and 400 feet south of milepost 490	654.875
Kiamichi, ¾ mile northeast of; post oak 15 inches diameter, 40 feet right of track and 50 feet north of milepost 495	602.945
Tuskahoma; in northeast corner of foundation of water tank, copper bolt	568.616
Clayton, ¾ mile northeast of; post oak 10 inches diameter, 60 feet right of track and 80 feet northwest of milepost 506, near intersection with the north boundary of T. 1 N., R. 19 E.	574.944
Elzey, ½ mile northeast of; red oak 24 inches diameter, 50 feet right of track and 400 feet north of milepost 510	535.34
Stanley; hickory 10 inches diameter, 60 feet left of track and 440 feet southwest of milepost 514	516.263

ALONG THE CHOCTAW, OKLAHOMA AND GULF RAILROAD FROM REDOAK TO GAINES CREEK.

Redoak, ¾ mile west of; post oak, 105 feet right of track and 165 feet west of milepost 195	594.22
Panola, 5 miles west of; post oak 22 inches diameter, 110 feet right of track and 165 feet west of milepost 191	614.509
Panola, ½ mile east of; first coping stone of northwest pier of bridge 61, copper bolt	623.368
Bridge 65; square hole cut into first coping stone of north end of west abutment	591.636
Wilburton; water elm 9 inches diameter, 285 feet east and 125 feet north of milepost 182, near bridge 73	647.096
Wilburton, 2 miles west of; coping stone of north end west abutment of bridge 77, copper bolt	677.327
Wilburton, 4 miles west of; square hole cut into stone at northeast corner of north end of culvert, 30 feet east of milepost 178	675.832
Wilburton, 7 miles west of; south end of east abutment of bridge 80, near milepost 175, copper bolt set in stone	632.635
Bridge 90 (over Gaines Creek); square hole cut into north end of west abutment	639.747

ALONG TOWNSHIP LINES.

Corner Ts. 5 and 6 N., Rs. 21 and 22 E., iron post	549.351
Corner Ts. 5 and 6 N., Rs. 20 and 21 E., iron post	699.621
Corner Ts. 5 and 6 N., Rs. 19 and 20 E., iron post	884.762
Corner Ts. 5 and 6 N., Rs. 18 and 19 E., iron post	624.472
Corner Ts. 5 and 6 N., Rs. 17 and 18 E., iron post	702.602
Closing corner T. 4 N., Rs. 17 and 18 E., iron post	628.038
Standard corner T. 5 N., Rs. 17 and 18 E., iron post	622.89
Closing corner T. 4 N., Rs. 18 and 19 E., iron post	1,342.745
Standard corner T. 5 N., Rs. 18 and 19 E., iron post	1,228.141
Closing corner T. 4 N., Rs. 19 and 20 E., iron post	839.385
Standard corner T. 5 N., Rs. 19 and 20 E., iron post	806.075
Closing corner T. 4 N., Rs. 20 and 21 E., iron post	759.274
Standard corner T. 5 N., Rs. 20 and 21 E., iron post	740.274
Closing corner T. 4 N., Rs. 21 and 22 E., iron post	841.214
Standard corner T. 5 N., Rs. 21 and 22 E., iron post	797.724

	Feet.
Corner Ts. 3 and 4 N., Rs. 21 and 22 E., iron post	715.576
Corner Ts. 3 and 4 N., Rs. 20 and 21 E., iron post	1,802.133
Corner Ts. 3 and 4 N., Rs. 19 and 20 E., iron post	1,058.955
Corner Ts. 3 and 4 N., Rs. 18 and 19 E., iron post	902.585
Corner Ts. 3 and 4 N., Rs. 17 and 18 E., iron post	839.716
Corner Ts. 2 and 3 N., Rs. 17 and 18 E., iron post	1,043.945
Corner Ts. 2 and 3 N., Rs. 18 and 19 E., iron post	598.525
Corner Ts. 2 and 3 N., Rs. 19 and 20 E., iron post	893.805
Corner Ts. 2 and 3 N., Rs. 20 and 21 E., iron post	1,094.81
Corner Ts. 2 and 3 N., Rs. 21 and 22 E., iron post	657.34
Corner Ts. 1 and 2 N., Rs. 21 and 22 E., iron post	1,534.624
Corner Ts. 1 and 2 N., Rs. 20 and 21 E., iron post	1,501.784
Corner Ts. 1 and 2 N., Rs. 19 and 20 E., iron post	1,334.355
Corner Ts. 1 and 2 N., Rs. 18 and 19 E., iron post	622.3
Corner Ts. 1 and 2 N., Rs. 17 and 18 E., iron post	1,344.5
Closing corner T. 1 S., Rs. 17 and 18 E., iron post	722.605
Standard corner T. 1 N., Rs. 17 and 18 E., iron post	680.64
Closing corner T. 1 S., Rs. 18 and 19 E., iron post	1,064.64
Standard corner T. 1 N., Rs. 18 and 19 E., iron post	1,090.69
Closing corner T. 1 S., Rs. 19 and 20 E., iron post	1,081.985
Standard corner T. 1 N., Rs. 19 and 20 E., iron post	978.41
Closing corner T. 1 S., Rs. 20 and 21 E., iron post	1,167.597
Standard corner T. 1 N., Rs. 20 and 21 E., iron post	960.317
Closing corner T. 1 S., Rs. 21 and 22 E., iron post	754.033
Standard corner T. 1 N., Rs. 21 and 22 E., iron post	803.332

McALESTER QUADRANGLE.

Messrs. E. L. Faison, G. A. Purington, and H. C. McCluer ran the railroad levels. Messrs. T. C. Catchings, H. L. Muldrow, F. E. Fellows, E. L. Faison, and W. S. D. Moore had independent level parties. Messrs. W. A. Correll and Chase Doster were attached to the topographic and subdivision party of Mr. G. S. Smith, and Messrs. G. A. Purington and W. S. D. Moore were with that of Mr. W. B. Corse for a time.

FROM M'ALESTER, ALONG THE MISSOURI, KANSAS AND TEXAS RAILWAY, TO LIMESTONE GAP.

	Feet.
McAlester, ½ mile north of; copper bolt set into stone culvert, 250 feet north of mile pole 564	677.606
South McAlester; iron post in northwest angle of the Choctaw, Oklahoma and Gulf and Missouri, Kansas and Texas railroads, 49.42 feet west from the southwest corner of the Union Station	716.034
South McAlester; bronze tablet set into second base stone, 9.7 feet from southwest corner of the Kali-Inla Building, on side of Front street facing south, which building is owned by the Choctaw, Oklahoma and Gulf Railroad Company	722.36
Frink; nail in hickory 14 inches diameter, 60 feet right of track and 50 feet south of mile pole 569	753.303
Savanna, ½ mile south of; spike in telegraph pole at mile board 575	701.289
Kiowa; nail in post oak, 30 inches diameter, 50 feet left of track and 200 feet north of mile pole 583	738.612
Limestone Gap; nail in elm 18 inches diameter, 225 feet right of track and directly behind mile pole 591	641.127

FROM HARTSHORNE, ALONG THE CHOCTAW, OKLAHOMA AND GULF RAILROAD, TO BARNETT.

	Feet.
Bridge 93; square hole cut into stone on south end of west abutment	645.662
Hartshorne; bronze tablet set into fourth stone above the foundation course, at the northeast corner of stone building owned by F. M. Savage, situated on Pennsylvania avenue, 125 feet west of west line of Fifth street, 670 feet south of main line of railroad, and 2,500 feet east of post-office building	703.939
Hartshorne, 13 miles west of; copper bolt in north end of culvert, 650 feet west of mine No. 1	676.235
Hartshorne, 2 miles west of; copper bolt set into stone on north end of parapet wall of bridge 106	606.708
Alderson; copper bolt set into north end of west abutment of bridge 112	680.853
Alderson, 1 mile west of; square hole cut into stone on south end of west abutment of bridge 117, 75 feet east of mile pole 156	648.805
Krebs, ½ mile west of; square hole cut into stone on southeast corner of east abutment of bridge 124	718.168
McAlester, 6 miles west of; cross (+) mark on top stone of west pier of bridge 206, 150 feet west of mile pole 145	650.852
Barnett, ¾ mile east of; bronze tablet set into southwest corner of top stone of west pier of bridge 198, 550 feet west of mile pole 141, 10 miles west of McAlester	701.142

ON ST. LOUIS AND SAN FRANCISCO RAILROAD.

Butler, 4 miles north of; nail in red oak, 8 inches diameter, 40 feet left of track and 60 feet north of mile pole 518, near the intersection of the railroad witht he base line	513.589

ALONG TOWNSHIP LINES.

Corner Ts. 5 and 6 N., Rs. 12 and 13 E., iron post	764.15
Corner Ts. 5 and 6 N., Rs. 13 and 14 E., iron post	623.978
Corner Ts. 5 and 6 N., Rs. 14 and 15 E., iron post	719.724
Corner Ts. 5 and 6 N., Rs. 15 and 16 E., iron post	602.946
Corner Ts. 5 and 6 N., Rs. 16 and 17 E., iron post	678.867
Standard corner T. 5 N., Rs. 16 and 17 E., iron post	668.363
Closing corner T. 4 N., Rs. 16 and 17 E., iron post	668.615
Standard corner T. 5 N., Rs. 15 and 16 E., iron post	623.839
Closing corner T. 4 N., Rs. 15 and 16 E., iron post	622.725
Standard corner T. 5 N., Rs. 14 and 15 E., iron post	794.655
Closing corner T. 4 N., Rs. 14 and 15 E., iron post	810.525
Standard corner T. 5 N., Rs. 13 and 14 E., iron post	782.853
Closing corner T. 4 N., Rs. 13 and 14 E., iron post	798.279
Standard corner T. 5 N., Rs. 12 and 13 E., iron post	705.382
Closing corner T. 4 N., Rs. 12 and 13 E., iron post	699.261
Corner Ts. 3 and 4 N., Rs. 12 and 13 E., iron post	781.088
Corner Ts. 3 and 4 N., Rs. 13 and 14 E., iron post	731.686
Corner Ts. 3 and 4 N., Rs. 14 and 15 E., iron post	787.461
Corner Ts. 3 and 4 N., Rs. 15 and 16 E., iron post	759.212
Corner Ts. 3 and 4 N., Rs. 16 and 17 E., iron post	925.96
Corner Ts. 2 and 3 N., Rs. 16 and 17 E., iron post	704.692
Corner Ts. 2 and 3 N., Rs. 15 and 16 E., iron post	888.43
Corner Ts. 2 and 3 N., Rs. 14 and 15 E., iron post	1,068.734

	Feet.
rner Ts. 2 and 3 N., Rs. 13 and 14 E., iron post	773.199
rner Ts. 2 and 3 N., Rs. 12 and 13 E., iron post	718.35
orner Ts. 1 and 2 N., Rs. 12 and 13 E., iron post	824.747
orner Ts. 1 and 2 N., Rs. 13 and 14 E., iron post	789.85
orner Ts. 1 and 2 N., Rs. 14 and 15 E., iron post	996.
orner Ts. 1 and 2 N., Rs. 15 and 16 E., iron post	1,025.
orner Ts. 1 and 2 N., Rs. 16 and 17 E., iron post	703.
tandard corner T. 1 N., Rs. 16 and 17 E., iron post	1,016.855
losing corner T. 1 S., Rs. 16 and 17 E., iron post	975.854
tandard corner T. 1 N., Rs. 15 and 16 E., iron post	1,081.443
losing corner T. 1 S., Rs. 15 and 16 E., iron post	1,038.518
Standard corner T. 1 N., Rs. 14 and 15 E., iron post	969.031
Closing corner T. 1 S., Rs. 14 and 15 E., iron post	964.431
Standard corner T. 1 N., Rs. 13 and 14 E., iron post	748.611
Closing corner T. 1 S., Rs. 13 and 14 E., iron post	755.499
Standard corner T. 1 N., Rs. 12 and 13 E., iron post	660.205
Closing corner T. 1 S., Rs. 12 and 13 E., iron post	657.105

COALGATE QUADRANGLE.

The railroad levels were run by Messrs. G. A. Purington, W. R. Manning, and E. L. Faison. Messrs. R. Coe, T. C. Catchings, F. E. Fellows, and W. S. D. Moore had independent level parties, while Mr. J. P. Walker was attached to the topographic and subdivision party of Mr. Jeremiah Ahern, and Mr. H. L. Muldrow, jr., to that of Mr. R. H. McKee.

FROM STUART, ALONG THE CHOCTAW, OKLAHOMA AND GULF RAILROAD, TO CALVIN.

	Feet.
Stuart, 3 miles east of; square hole cut in northwest corner of top stone on the south side of west pier of bridge No. 187	692.225
Stuart, 1 mile east of; square hole cut in large stone 300 feet west of bridge No. 186, and 40 feet north of track near entrance to "cut"	708.088
Stuart; iron post 60 feet north of track, 100 feet east of station, and south post-office	721.885
Calvin, 2 miles east of; iron spike in mile pole No. 123	706.711
Calvin; iron post south of track, in line of telegraph poles, 210 feet west of Calvin station ticket-office window	714.693
Calvin, 4 miles west of; iron spike in mile pole No. 117	710.564

ON THE MISSOURI, KANSAS AND TEXAS RAILWAY.

Chili; post oak 30 inches in diameter, 60 feet left of track and 450 feet south of mile pole No. 596	663.655
Chili, 3 miles south of; elm 10 inches in diameter, 100 feet right of track, and 700 feet north of mile pole No. 599	617.53

ON COALGATE BRANCH OF MISSOURI, KANSAS AND TEXAS RAILWAY.

Coalgate; iron post flush with ground at the southeast corner of station building, 50 feet east of track	614.637
Coalgate; bronze tablet set into layer of foundation stone, 8 inches above the ground at the northwest corner of building owned by Cooperative Company, situated on Broadway street, about 400 feet southwest of railway station building	614.714

Google

ALONG TOWNSHIP LINES.

	Feet.
Corner Ts. 5 and 6 N., Rs. 8 and 9 E., iron post	[illegible]
Corner Ts. 5 and 6 N., Rs. 9 and 10 E., iron post	[illegible]
Corner Ts. 5 and 6 N., Rs. 10 and 11 E., iron post	[illegible]
Corner Ts. 5 and 6 N., Rs. 11 and 12 E., iron post	[illegible]
Standard corner T. 5 N., Rs. 11 and 12 E., iron post	[illegible]
Closing corner T. 4 N., Rs. 11 and 12 E., iron post	[illegible]
Standard corner T. 5 N., Rs. 10 and 11 E., iron post	[illegible]
Closing corner T. 4 N., Rs. 10 and 11 E., iron post	[illegible]
Standard corner T. 5 N., Rs. 9 and 10 E., iron post	[illegible]
Closing corner T. 4 N., Rs. 9 and 10 E., iron post	824.[illegible]
Standard corner T. 5 N., Rs. 8 and 9 E., iron post	[illegible]
Choctaw-Chickasaw boundary line, closing corner Ts. 4 and 5 N., R. 8 E., iron post	[illegible]
Choctaw-Chickasaw boundary line, closing corner Ts. 3 and 4 N., R. 8 E., iron post	[illegible]
Corner Ts. 3 and 4 N., Rs. 8 and 9 E., iron post	[illegible]
Corner Ts. 3 and 4 N., Rs. 9 and 10 E., iron post	[illegible]
Corner Ts. 3 and 4 N., Rs. 10 and 11 E., iron post	[illegible]
Corner Ts. 3 and 4 N., Rs. 11 and 12 E., iron post	[illegible]
Corner Ts. 2 and 3 N., Rs. 11 and 12 E., iron post	[illegible]
Corner Ts. 2 and 3 N., Rs. 10 and 11 E., iron post	[illegible]
Corner Ts. 2 and 3 N., Rs. 9 and 10 E., iron post	[illegible]
Corner Ts. 2 and 3 N., Rs. 8 and 9 E., iron post	697.[illegible]
Choctaw-Chickasaw boundary line, closing corner Ts. 2 and 3 N., R. 8 E., iron post	727.[illegible]
Choctaw-Chickasaw boundary line, closing corner Ts. 1 and 2 N., R. 8 E., iron post	628.[illegible]
Corner Ts. 1 and 2 N., Rs. 8 and 9 E., iron post	674.[illegible]
Corner Ts. 1 and 2 N., Rs. 9 and 10 E., iron post	664.[illegible]
Corner Ts. 1 and 2 N., Rs. 10 and 11 E., iron post	626.[illegible]
Corner Ts. 1 and 2 N., Rs. 11 and 12 E., iron post	640.[illegible]
Standard corner T. 1 N., Rs. 11 and 12 E., iron post	679.[illegible]
Standard corner T. 1 N., Rs. 10 and 11 E., iron post	563.[illegible]
Standard corner T. 1 N., Rs. 9 and 10 E., iron post	657.[illegible]
Standard corner T. 1 N., Rs. 8 and 9 E., iron post	649.[illegible]
Choctaw-Chickasaw boundary line, closing corner Ts. 1 N. and 1 S., R. 8 E., iron post	732.94[illegible]

ALONG THE CHICKASAW-CHOCTAW BOUNDARY LINE.

Closing corner of Chickasaw Survey, on Chickasaw-Choctaw boundary, between Ts. 1 and 2 N., R. 8 E., iron post	629.25[illegible]
Closing corner of Chickasaw Survey, on Chickasaw-Choctaw boundary, between Ts. 2 and 3 N., R. 8 E., iron post	728.5[illegible]
Closing corner of Chickasaw Survey, on Chickasaw-Choctaw boundary, between Ts. 3 and 4 N., R. 8 E., iron post	760.547
Closing corner of Chickasaw Survey, on Chickasaw-Choctaw boundary, between Ts. 4 and 5 N., R. 8 E., iron post	777.995

STONEWALL QUADRANGLE (INDIAN TERRITORY-OKLAHOMA).

Messrs. W. R. Manning and W. S. D. Moore had charge of independent level parties. Mr. J. P. Walker was attached to the subdivision and topographic party of Mr. Jeremiah Ahern, while Mr. E. M. Fry was with Mr. R. A. Farmer's party, and Mr. H. L. Muldrow, jr., with Mr. R. H. McKee's party.

ALONG TOWNSHIP AND SECTION LINES.

	Feet.
Canadian River, meander corner on; between T. 5 N., R. 3 E., sec. 2, and T. 6 N., R. 3 E., sec. 35, iron post	916.65
Canadian River, meander corner on; between T. 6 N., R. 3 E., sec. 25, and T. 6 N., R. 4 E., sec. 30, iron post	905.28
Corner Ts. 5 and 6 N., Rs. 3 and 4 E., iron post	1,025.43
Canadian River, meander corner on; between T. 5 N., R. 4 E., sec. 5, and T. 6 N., R. 4 E., sec. 32, iron post	896.85
Canadian River, meander corner on; between T. 5 N., R. 4 E., sec. 1, and T. 5 N., R. 5 E., sec. 6, iron post	878.794
Seminole-Oklahoma boundary, closing corner on; between fractional Ts. 5 and 6 N., R. 5 E., iron post	1,054.695
Corner Ts. 5 and 6 N., Rs. 5 and 6 E., iron post	929.989
Corner Ts. 5 and 6 N., Rs. 6 and 7 E., iron post	889.552
Corner Ts. 5 and 6 N., Rs. 7 and 8 E., iron post	850.683
Standard corner T. 5 N., Rs. 7 and 8 E., iron post	918.331
Closing corner T. 4 N., Rs. 7 and 8 E., iron post	947.576
Standard corner T. 5 N., Rs. 6 and 7 E., iron post	955.867
Closing corner T. 4 N., Rs. 6 and 7 E., iron post	946.223
Standard corner T. 5 N., Rs. 5 and 6 E., iron post	896.745
Closing corner T. 4 N., Rs. 5 and 6 E., iron post	884.069
Standard corner T. 5 N., Rs. 4 and 5 E., iron post	999.868
Closing corner T. 4 N., Rs. 4 and 5 E., iron post	1,006.824
Standard corner T. 5 N., Rs. 3 and 4 E., iron post	1,094.94
Closing corner T. 4 N., Rs. 3 and 4 E., iron post	1,081.925
Corner Ts. 3 and 4 N., Rs. 3 and 4 E., iron post	1,083.302
Corner Ts. 3 and 4 N., Rs. 4 and 5 E., iron post	974.885
Corner Ts. 3 and 4 N., Rs. 5 and 6 E., iron post	932.219
Corner Ts. 3 and 4 N., Rs. 6 and 7 E., iron post	966.648
Corner Ts. 3 and 4 N., Rs. 7 and 8 E., iron post	843.572
Corner Ts. 2 and 3 N., Rs. 7 and 8 E., iron post	751.493
Corner Ts. 2 and 3 N., Rs. 6 and 7 E., iron post	750.477
Corner Ts. 2 and 3 N., Rs. 5 and 6 E., iron post	1,049.052
Corner Ts. 2 and 3 N., Rs. 4 and 5 E., iron post	1,169.605
Corner Ts. 2 and 3 N., Rs. 3 and 4 E., iron post	1,168.524
Corner Ts. 1 and 2 N., Rs. 3 and 4 E., iron post	1,078.938
Corner Ts. 1 and 2 N., Rs. 4 and 5 E., iron post	1,253.431
Corner Ts. 1 and 2 N., Rs. 5 and 6 E., iron post	1,139.508
Corner Ts. 1 and 2 N., Rs. 6 and 7 E., iron post	822.716
Corner Ts. 1 and 2 N., Rs. 7 and 8 E., iron post	745.122
Standard corner T. 1 N., Rs. 7 and 8 E., iron post	793.223
Standard corner T. 1 N., Rs. 6 and 7 E., iron post	1,061.658
Standard corner T. 1 N., Rs. 5 and 6 E., iron post	1,098.691
Standard corner T. 1 N., Rs. 4 and 5 E., iron post	1,159.841
Closing corner T. 1 S., Rs. 4 and 5 E., iron post	1,155.909
Standard corner T. 1 N., Rs. 3 and 4 E., iron post	1,198.234
Closing corner T. 1 S., Rs. 3 and 4 E., iron post	1,194.88

PAULS VALLEY QUADRANGLE (INDIAN TERRITORY-OKLAHOMA).

Messrs. R. Coe and A. F. Hassan ran the railroad levels. Mr. W. R. Manning had an independent level party. Messrs. W. S. D. Moore, G. Given, and E. M. Fry were attached to the subdivision and topographic party of Mr. R. A. Farmer, and Mr. J. H. Carlock to that of Mr. C. W. Goodlove.

FROM DAVIS, NORTH ALONG GULF, COLORADO AND SANTA FE RAILWAY, TO WAYNE.

	Feet.
Davis, ¼ mile north of; iron post set at intersection of Indian base line with the line of telegraph poles adjacent to railway, and about 28 feet west of center of track, and 48 feet north of tenth telegraph pole north of mile pole 478	838.434
Wynnewood, 3½ miles south of; iron post at intersection of the railway with the north boundary T. 1 N., R. 1 E., and 24 feet west of center of track, and in line with telegraph poles	820.317
Wynnewood; bronze tablet set in foundation stone of Citizen's Bank building, 12 feet south of northeast corner of building, which is situated on Cherokee street and Guy avenue	862.616
Wynnewood, 2¾ miles north of; iron post set at intersection of railway with north boundary T. 2 N., R. 1 E., and 33 feet west of center of track and in line with telegraph poles, and about 3 poles south of mile pole 491	843.292
Pauls Valley; bronze tablet in center of east face of second stone above foundation at northeast corner of stone building owned by C. J. Grant, situated at corner of Paul and Santa Fe avenues	871.182
Pauls Valley, 2½ miles northwest of; iron post, set 12 inches out of ground, at the corner of Ts. 3 and 4 N., Rs. 1 E. and 1 W., about 900 feet west of railway	882.772
Paoli, 2 miles north of; iron post, 9 inches out of ground, at witness corner to ¼ section corner of sec. 36, T. 5 N., R. 1 W., and 300 feet east of intersection of railway with first standard parallel north	933.189
Wayne; railroad spike in fifth telegraph pole south of station building and second pole north of mile pole 510	1,097.466

ALONG TOWNSHIP AND SECTION LINES.

Corner Ts. 5 and 6 N., Rs. 2 and 3 W., iron post	1,075.851
Corner Ts. 5 and 6 N., Rs. 1 and 2 W., iron post	1,119.411
Corner Ts. 5 and 6 N., Rs. 1 E. and 1 W., iron post	997.561
Canadian River; meander corner on T. 6 N., Rs. 1 E. and 1 W., secs. 31 and 36, iron post	988.041
Canadian River, meander corner on; between T. 5 N., R. 1 E., sec. 1, and T. 5 N., R. 2 E., sec. 6, iron post	967.577
Canadian River, meander corner on; between T. 5 N., R. 2 E., sec. 13, and T. 5 N., R. 3 E., sec. 18, iron post	937.053
Standard corner T. 5 N., Rs. 2 and 3 E., iron post	1,021.873
Closing corner T. 4 N., Rs. 2 and 3 E., iron post	1,013.892
Standard corner T. 5 N., Rs. 1 and 2 E., iron post	1,063.907
Closing corner T. 4 N., Rs. 1 and 2 E., iron post	1,052.255
Indian meridian, standard corner Ts. 4 and 5 N., Rs. 1 E. and 1 W., at intersection of the first standard parallel north with the, iron post	947.571
Closing corner T. 4 N., Rs. 1 and 2 W., iron post	1,023.479
Standard corner T. 5 N., Rs. 1 and 2 W., iron post	1,011.619
Closing corner T. 4 N., Rs. 2 and 3 W., iron post	980.159
Standard corner T. 5 N., Rs. 2 and 3 W., iron post	966.349
Corner Ts. 3 and 4 N., Rs. 2 and 3 W., iron post	988.152
Corner Ts. 3 and 4 N., Rs. 1 and 2 W., iron post	977.882
Corner Ts. 3 and 4 N., Rs. 1 and 2 E., iron post	920.582

	Feet.
Corner Ts. 3 and 4 N., Rs. 2 and 3 E., iron post	1,040.562
Corner Ts. 2 and 3 N., Rs. 2 and 3 E., iron post	1,104.464
Corner Ts. 2 and 3 N., Rs. 1 and 2 E., iron post	870.954
Corner Ts. 2 and 3 N., Rs. 1 E. and 1 W., iron post	890.792
Corner Ts. 2 and 3 N., Rs. 1 and 2 W., iron post	1,051.402
Corner Ts. 2 and 3 N., Rs. 2 and 3 W., iron post	1,091.122
Corner Ts. 1 and 2 N., Rs. 2 and 3 W., iron post	983.612
Corner Ts. 1 and 2 N., Rs. 1 and 2 W., iron post	939.652
Corner Ts. 1 and 2 N., Rs. 1 E. and 1 W., iron post	875.342
Corner Ts. 1 and 2 N., Rs. 1 and 2 E., iron post	839.468
Corner Ts. 1 and 2 N., Rs. 2 and 3 E., iron post	1,047.678
Standard corner T. 1 N., Rs. 2 and 3 E., iron post	944.134
Closing corner T. 1 S., Rs. 2 and 3 E., iron post	936.402
Standard corner T. 1 N., Rs. 1 and 2 E., iron post	786.783
Closing corner T. 1 S., Rs. 1 and 2 E., iron post	788.531
Indian meridian and Indian base, corner Ts. 1 N. and 1 S., Rs. 1 E. and 1 W.; a copper bolt set in rock in place, 4 feet south of initial point, at the intersection of the	1,040.137
Standard corner T. 1 N., Rs. 1 and 2 W., iron post	967.267
Closing corner T. 1 S., Rs. 2 and 3 W., iron post	930.617
Standard corner T. 1 N., Rs. 2 and 3 W., iron post	925.147

RUSH SPRINGS QUADRANGLE.

The railroad levels were run by Mr. R. Coe. Messrs. E. M. Fry and W. S. D. Moore were attached to the subdivision and topographic party of Mr. R. A. Farmer, and Messrs. J. P. Thayer and J. P. Walker and H. L. Baker were with Mr. A. D. Morton's party. Mr. W. R. Manning had charge of an independent party and ran a few miles on the base line.

FROM NINNEKAH, SOUTH ALONG CHICAGO, ROCK ISLAND AND PACIFIC RAILWAY, TO DUNCAN.

	Feet.
Ninnekah, ¾ mile south of; railroad spike in telegraph mile pole 444, which is 200 feet south of north boundary T. 5 N., R. 7 W	1,100.358
Rush Springs, 6 miles north of; iron post, 10 inches out of ground, on first standard parallel north, between T. 4 N., R. 7 W., sec. 4, and T. 5 N., R. 7 W., sec. 33, and is 37.9 feet west of track and 15.3 feet south of 20th telegraph pole north of mile pole 451	1,291.676
Rush Springs; bronze tablet in middle of northeast face of second stone above sidewalk and on left side of main entrance to the Masonic building. This bench mark is 1 mile north of township line	1,349.054
Marlow, 2½ miles north of; iron post, 12 inches out of ground, at section corner between T. 2 N., R. 7 W., secs. 5 and 4, and T. 3 N., R. 7 W., secs. 32 and 33, and 50 feet west of track	1,331.237
Marlow, 3¾ miles south of; iron post, 12 inches out of ground, at section corner between T. 1 N., R. 7 W., secs. 4 and 5, and T. 2 N., R. 7 W., secs. 32 and 33, and 730 feet east of track	1,304.429
Duncan, ⅓ mile north of; iron post, 8 inches out of ground on Indian base line, at quarter section corner between T. 1 N., R. 7 W., sec. 32, and T. 1 S., R. 7 W., sec. 5, and 1,000 feet west of track	1,127.137

ALONG TOWNSHIP LINES.

	Feet.
Chickasaw Nation, closing corner Ts. 5 and 6 N., R. 7 W., on the west boundary of; iron post	1,095.[illegible]
Corner Ts. 5 and 6 N., Rs. 6 and 7 W., iron post	1,162.[illegible]
Corner Ts. 5 and 6 N., Rs. 5 and 6 W., iron post	1,018.[illegible]
Corner Ts. 5 and 6 N., Rs. 4 and 5 W., iron post	1,139.[illegible]
Corner Ts. 5 and 6 N., Rs. 3 and 4 W., iron post	1,010.071
Closing corner T. 4 N., Rs. 3 and 4 W., iron post	963.[illegible]
Standard corner T. 5 N., Rs. 3 and 4 W., iron post	962.[illegible]
Closing corner T. 4 N., Rs. 4 and 5 W., iron post	994.[illegible]
Standard corner T. 5 N., Rs. 4 and 5 W., iron post	994.7[illegible]
Closing corner T. 4 N., Rs. 5 and 6 W., iron post	1,093.[illegible]
Standard corner T. 5 N., Rs. 5 and 6 W., iron post	1,124.2[illegible]
Closing corner T. 4 N., Rs. 6 and 7 W., iron post	1,233.[illegible]
Standard corner T. 5 N., Rs. 6 and 7 W., iron post	1,280.416
Chickasaw Nation, closing corner Ts. 4 and 5 N., R. 7 W., on the west boundary, iron post	1,285.[illegible]
Chickasaw Nation, closing corner Ts. 3 and 4 N., R. 7 W., on west boundary, iron post	1,389.47[illegible]
Corner Ts. 3 and 4 N., Rs. 6 and 7 W., iron post	1,280.3[illegible]
Corner Ts. 3 and 4 N., Rs. 5 and 6 W., iron post	1,266.04[illegible]
Corner Ts. 3 and 4 N., Rs. 4 and 5 W., iron post	1,078.2[illegible]
Corner Ts. 3 and 4 N., Rs. 3 and 4 W., iron post	1,154.8[illegible]
Corner Ts. 2 and 3 N., Rs. 3 and 4 W., iron post	1,188.532
Corner Ts. 2 and 3 N., Rs. 4 and 5 W., iron post	1,158.045
Corner Ts. 2 and 3 N., Rs. 5 and 6 W., iron post	1,303.954
Corner Ts. 2 and 3 N., Rs. 6 and 7 W., iron post	1,368.898
Chickasaw Nation, closing corner Ts. 2 and 3 N., R. 7 W., on west boundary, iron post	1,272.209
Chickasaw Nation, closing corner Ts. 1 and 2 N., R. 8 W., on west boundary, iron post	1,207.26[illegible]
Corner Ts. 1 and 2 N., Rs. 7 and 8 W., iron post	1,223.689
Corner Ts. 1 and 2 N., Rs. 6 and 7 W., iron post	1,209.996
Corner Ts. 1 and 2 N., Rs. 5 and 6 W., iron post	1,152.154
Corner Ts. 1 and 2 N., Rs. 4 and 5 W., iron post	1,111.915
Corner Ts. 1 and 2 N., Rs. 3 and 4 W., iron post	1,116.062
Closing corner T. 1 S., Rs. 3 and 4 W., iron post	1,006.949
Standard corner T. 1 N., Rs. 3 and 4 W., iron post	1,016.101
Closing corner T. 1 S., Rs. 4 and 5 W., iron post	1,101.581
Standard corner T. 1 N., Rs. 4 and 5 W., iron post	1,101.837
Closing corner T. 1 S., Rs. 5 and 6 W., iron post	1,105.384
Standard corner T. 1 N., Rs. 5 and 6 W., iron post	1,093.664
Standard corner T. 1 N., Rs. 6 and 7 W., iron post	1,224.758
Closing corner T. 1 S., Rs. 7 and 8 W., iron post	1,119.069
Standard corner T. 1 N., Rs. 7 and 8 W., iron post	1,123.645
Closing corner Ts. 1 N. and 1 S., R. 8 W., which is intersection of base line and west boundary Chickasaw Nation; iron post	1,123.614

CHICKASHA QUADRANGLE (INDIAN TERRITORY-OKLAHOMA).

Mr. R. Coe ran the railroad levels. Mr. E. M. Fry was attached to the subdivision and topographic party of Mr. R. A. Farmer.

FROM MINCO, SOUTH ALONG CHICAGO, ROCK ISLAND AND PACIFIC RAILWAY, TO CHICKASHA.

	Feet.
Minco, 1½ miles south of; iron post, 12 inches out of ground, at ¼ section corner between T. 9 N., R. 7 W., sec. 4, and T. 10 N., R. 7 W., sec. 33, and about 150 feet east of track	1,283.774
Minco, 7½ miles south of; iron post, 15 inches out of ground, at corner to secs. 32 and 33, of T. 9 N., R. 7 W., on the second standard parallel north, and about 600 feet west of track	1,201.295
Chickasha, 4½ miles north of; iron post, 12 inches out of ground, at ¼ section corner between T. 7 N., R. 7 W., sec. 4, and T. 8 N., R. 7 W., sec. 33, about 600 feet east of track	1,101.79
Chickasha; bronze tablet set in middle of east face of foundation stone at northeast corner of brick building owned by J. C. Griggers and situated at the corner of Chickasha avenue and Second street	1,090 967
Chickasha, 1¾ miles south of; iron post, 8 inches out of ground, at ¼ section corner between T. 6 N., R. 7 W., sec. 3, and T. 7 N., R. 7 W., sec. 34, about 180 feet west of track	1,084.071

ALONG TOWNSHIP AND SECTION LINES.

Chickasaw Nation, closing corner of Ts. 9 and 10 N., R. 7 W., on the west boundary of; iron post	1,287.534
Corner Ts. 9 and 10 N., Rs. 6 and 7 W., iron post	1,332.564
Corner Ts. 9 and 10 N., Rs. 5 and 6 W., iron post	1,306.784
Corner Ts. 9 and 10 N., Rs. 4 and 5 W., iron post	1,282.664
Canadian River, meander corner on, between T. 9 N., R. 4 W., sec. 1, and T. 10 N., R. 4 W., sec. 36; iron post	1,144.084
Canadian River, meander corner on, between T. 8 N., R. 3 W., sec. 5, and T. 9 N., R. 3 W., sec. 32; iron post	1,110.827
Closing corner T. 8 N., Rs. 3 and 4 W., iron post	1,177.227
Standard corner T. 9 N., Rs. 3 and 4 W., iron post	1,180.967
Closing corner T. 8 N., Rs. 4 and 5 W., iron post	1,283.967
Standard corner T. 9 N., Rs. 4 and 5 W., iron post	1,290.657
Closing corner T. 8 N., Rs. 5 and 6 W., iron post	1,288.605
Standard corner T. 9 N., Rs. 5 and 6 W., iron post	1,300.125
Closing corner T. 8 N., Rs. 6 and 7 W., iron post	1,222.395
Standard corner T. 9 N., Rs. 6 and 7 W., iron post	1,206.805
Chickasaw Nation, closing corner Ts. 8 and 9 N., R. 7 W., on the west boundary of; iron post	1,184.225
Chickasaw Nation, closing corner Ts. 7 and 8 N., R. 7 W., on the west boundary of; iron post	1,165.22
Corner Ts. 7 and 8 N., Rs. 6 and 7 W., iron post	1,218.47
Corner Ts. 7 and 8 N., Rs. 5 and 6 W., iron post	1,213.46
Corner Ts. 7 and 8 N., Rs. 4 and 5 W., iron post	1,260.247
Corner Ts. 7 and 8 N., Rs. 3 and 4 W., iron post	1,111.047
Corner Ts. 6 and 7 N., Rs. 3 and 4 W., iron post	1,219.167
Corner Ts. 6 and 7 N., Rs. 4 and 5 W., iron post	1,168.727
Corner Ts. 6 and 7 N., Rs. 5 and 6 W., iron post	1,152.061
Corner Ts. 6 and 7 N., Rs. 6 and 7 W., iron post	1,078,351
Chickasaw Nation, closing corner Ts. 6 and 7 N., R. 7 W., on the west boundary; iron post	1,155.551

PURCELL QUADRANGLE (INDIAN TERRITORY-OKLAHOMA).

Railroad levels were run by Mr. R. Coe. Messrs. W. S. D. Moore and E. M. Fry were attached to the subdivision and topographic party of Mr. R. A. Farmer.

ON THE GULF, COLORADO AND SANTA FE RAILWAY.

	Feet.
Purcell; bronze tablet set in middle of south face of second stone from southwest corner in the first course of stone above basement, in building used as U. S. court-house	1,091.681
Purcell, 4⅝ miles north of; on the northeast rivet on bridge plate on east side of south pier of bridge over Canadian River	1,057.533

ALONG TOWNSHIP AND SECTION LINES.

Corner Ts. 7 and 8 N., Rs. 2 and 3 W., iron post	1,136.706
Canadian River, meander corner on, between T. 7 N., R. 2 W., sec. 4, and T. 8 N., R. 2 W., sec. 33; iron post	1,964.047
Canadian River, meander corner on, between T. 6 N., R. 2 W., sec. 1, and T. 7 N., R. 2 W., sec. 36; iron post	1,029.167
Corner Ts. 6 and 7 N., Rs. 2 and 3 W., iron post	1,124.077

SEMINOLE QUADRANGLE (INDIAN TERRITORY-OKLAHOMA).

The railroad levels were run by Mr. E. L. Faison. Messrs. W. S. D. Moore, W. R. Manning, and E. L. Faison had independent level parties.

FROM WEWOKA, INDIAN TERRITORY, ALONG CHOCTAW, OKLAHOMA AND GULF RAILROAD, TO SHAWNEE, OKLAHOMA.

	Feet.
Wewoka, 6 miles west of; iron spike in mile pole 93	833.464
Wewoka, 9 miles west of; iron post 5.7 feet west of mile pole 90	838.57
Earlsboro, Oklahoma Territory, 6 miles east of; iron spike in mile pole 85	861.912
Earlsboro; iron post 17 feet west of main track and 200 feet north of station building	1,024.714
Tecumseh; spike in telegraph pole at junction of the Choctaw, Oklahoma and Gulf Railroad and Tecumseh Railroad	991.38
Shawnee; iron post 15 feet north of track and at east end of station platform	1,040.674
Shawnee, 4 miles west of, near Dale; iron post at mile pole 66	1,018.128

ALONG TOWNSHIP LINES.

Creek-Oklahoma boundary, closing corner Ts. 11 and 12 N., R. 6 E., iron post	979.38
Corner Ts. 11 and 12 N., Rs. 6 and 7 E., iron post	921.773
Corner Ts. 11 and 12 N., Rs. 7 and 8 E., iron post	937.515
Corner Ts. 10 and 11 N., Rs. 7 and 8 E., iron post	989.174
Corner Ts. 10 and 11 N., Rs. 6 and 7 E., iron post	901.875
Corner Ts. 10 and 11 N., Rs. 5 and 6 E., iron post	989.61
Seminole-Oklahoma boundary line, closing corner Ts. 10 and 11 N., R. 5 E., iron post	946.122
Seminole-Oklahoma boundary, closing corner Ts. 9 and 10 N., R. 5 E., iron post	993.871

	Feet.
Corner Ts. 9 and 10 N., Rs. 5 and 6 E., iron post	1,017.957
Corner Ts. 9 and 10 N., Rs. 6 and 7 E., iron post	995.929
Corner Ts. 9 and 10 N., Rs. 7 and 8 E., iron post	990.638
Standard corner T. 9 N., Rs. 7 and 8 E., iron post	818.167
Standard corner T. 9 N., Rs. 6 and 7 E., iron post	853.218
Closing corner T. 8 N., Rs. 6 and 7 E., iron post	863.918
Standard corner T. 9 N., Rs. 5 and 6 E., iron post	844.141
Closing corner T. 8 N., Rs. 5 and 6 E., iron post	915.692
Seminole-Oklahoma boundary, closing corner Ts. 8 and 9 N., R. 5 E., iron post	930.24
Seminole-Oklahoma boundary, closing corner Ts. 7 and 8 N., R. 5 E., iron post	890.788
Corner Ts. 7 and 8 N., Rs. 5 and 6 E., iron post	901.809
Corner Ts. 7 and 8 N., Rs. 6 and 7 E., iron post	832.761
Corner Ts. 7 and 8 N., Rs. 7 and 8 E., iron post	956.785
Corner Ts. 6 and 7 N., Rs. 7 and 8 E., iron post	884.63
Corner Ts. 6 and 7 N., Rs. 6 and 7 E., iron post	848.919
Corner Ts. 6 and 7 N., Rs. 5 and 6 E., iron post	949.752
Seminole-Oklahoma boundary, closing corner Ts. 5 and 6 N., R. 5 E., iron post	910.974

SAC AND FOX QUADRANGLE (INDIAN TERRITORY-OKLAHOMA).

The level work of this quadrangle was done by two independent level parties, under Messrs. W. R. Manning and E. L. Faison, levelmen.

ALONG TOWNSHIP LINES.

	Feet.
Creek-Oklahoma boundary, closing corner Ts. 17 and 18 N., R. 6 E., iron post	829.713
Corner Ts. 17 and 18 N., Rs. 6 and 7 E., bronze tablet set into sandstone post, 48 by 8 by 6 inches, 45 inches in the ground	839.555
Corner Ts. 17 and 18 N., Rs. 7 and 8 E., iron post	920.835
Standard corner T. 17 N., Rs. 7 and 8 E., iron post	948.707
Closing corner T. 16 N., Rs. 7 and 8 E., iron post	956.193
Closing corner T. 16 N., Rs. 6 and 7 E., iron post	962.232
Creek-Oklahoma boundary, standard corner T. 17 N., Rs. 6 and 7 E. (which is also closing Ts. 16 and 17 N., R. 6), iron post	976.695
Creek-Oklahoma boundary, closing corner Ts. 15 and 16 N., R. 6 E., iron post	834.802
Corner Ts. 15 and 16 N., Rs. 6 and 7 E., iron post	844.058
Corner Ts. 15 and 16 N., Rs. 7 and 8 E., iron post	814.55
Corner Ts. 14 and 15 N., Rs. 7 and 8 E., iron post	765.315
Corner Ts. 14 and 15 N., Rs. 6 and 7 E., iron post	877.9
Creek-Oklahoma boundary, closing corner Ts. 14 and 15 N., R. 6 E., iron post	860.416
Creek-Oklahoma boundary, closing corner Ts. 13 and 14 N., R. 6 E., iron post	787.97
Corner Ts. 13 and 14 N., Rs. 6 and 7 E., iron post	783.811
Corner Ts. 13 and 14 N., Rs. 7 and 8 E., iron post	773.444
Standard corner T. 13 N., Rs. 7 and 8 E., iron post	861.855
Standard corner T. 13 N., Rs. 6 and 7 E., iron post	867.882
Creek-Oklahoma boundary, closing corner Ts. 12 and 13 N., R. 6 E.	866.51

PAWNEE QUADRANGLE (INDIAN TERRITORY-OKLAHOMA).

This bench mark was established by Mr. W. R. Manning on a double-rodded line.

	Feet.
Corner secs. 13 and 24, T. 18 N., R. 6 E., and secs. 18 and 19, T. 18 N., R. 7 E.; a sandstone post, 35 by 6 by 6 inches, with bronze tablet inserted	777.287

HOMINY QUADRANGLE (INDIAN TERRITORY-OKLAHOMA).

Mr. C. B. Odell ran the levels along the railroad, and he also had charge of an independent level party on township lines.

ALONG THE ST. LOUIS AND SAN FRANCISCO RAILROAD FROM RED FORK TO SAPULPA.

	Feet.
Red Fork, 3 miles south of; square hole cut in capstone of south pier of bridge over Nickle Creek	728.201
Sapulpa, bronze tablet set into wall of Gladstone Hotel, 14 feet from east end and 3.5 feet above porch	722.862
Sapulpa, copper bolt in sandstone post, 9 by 9 by 20 inches, buried flush with surface of ground, 11.5 feet from northwest corner of station	718.491

ALONG TOWNSHIP LINES.

Creek-Oklahoma boundary, closing corner of T. 19 N., Rs. 11 and 12 E., iron post	737.081
Corner Ts. 18 and 19 N., Rs. 11 and 12 E., iron post	746.531

ADDINGTON QUADRANGLE.

The railroad levels were run by Mr. R. Coe. Mr. Coe also had an independent party to run levels on the first standard parallel south. Messrs. J. P. Walker and H. L. Baker were attached to the subdivision and topographic party of Mr. A. D. Morton, while Messrs. R. T. Carnall and R. Coe were with Mr. J. Ahern's party and Mr. E. M. Fry with Mr. R. A. Farmer's party.

FROM COMANCHE, SOUTH ALONG THE CHICAGO, ROCK ISLAND AND PACIFIC RAILWAY, TO RYAN.

	Feet.
Comanche, 4 miles north of; a railroad spike in telegraph mile pole 481	1,024.795
Comanche, iron post 5 inches out of ground and on the south side of the station building; the post is set between the platform and a telegraph pole	979.723
Comanche, 2 miles south of; a railroad spike in telegraph mile pole 487	958.439
Addington, a square hole cut in the northwest corner of top stone of north foundation and in second tier from front of the water tank at	917.67
Addington, 4½ miles south of; square hole cut in coping stone on west end of south pier of bridge 3202 over Cow Creek, and about 1,100 feet north of mile pole 499	883.264
Sugden, ½ mile south of; an iron post at the standard corner of T. 5 S., Rs. 7 and 8 W., and about 1,600 feet west of the point of intersection of the railroad with the first standard parallel south	843.965
Ryan, 1 mile north of; on outside anchor bolt on west side of south pier of bridge 3212 over Beaver Creek	827.204

ALONG TOWNSHIP LINES.

	Feet.
Chickasaw Nation, closing corner fractional Ts. 1 and 2 S., R. 8 W., on west boundary, iron post	1,095.955
Corner Ts. 1 and 2 S., Rs. 7 and 8 W., iron post	1,123.275
Corner Ts. 1 and 2 S., Rs. 6 and 7 W., iron post	1,127.5
Corner Ts. 1 and 2 S., Rs. 5 and 6 W., iron post	1,081.88
Corner Ts. 1 and 2 S., Rs. 4 and 5 W., iron post	1,218.23
Corner Ts. 1 and 2 S., Rs. 3 and 4 W., iron post	1,084.679
Corner Ts. 2 and 3 S., Rs. 3 and 4 W., iron post	1,056.232
Corner Ts. 2 and 3 S., Rs. 4 and 5 W., iron post	967.009
Corner Ts. 2 and 3 S., Rs. 5 and 6 W., iron post	931.539
Corner Ts. 2 and 3 S., Rs. 6 and 7 W., iron post	987.769
Corner Ts. 2 and 3 S., Rs. 7 and 8 W., iron post	1,062.269
Chickasaw Nation, closing corner fractional Ts. 2 and 3 S., R. 8 W., on the west boundary of the, iron post	1,005.399
Chickasaw Nation, closing corner fractional Ts. 3 and 4 S., R. 8 W., on the west boundary of the, iron post	970.15
Corner Ts. 3 and 4 S., Rs. 7 and 8 W., iron post	908.29
Corner Ts. 3 and 4 S., Rs. 6 and 7 W., iron post	969.22
Corner Ts. 3 and 4 S., Rs. 5 and 6 W., iron post	856.87
Corner Ts. 3 and 4 S., Rs. 4 and 5 W., iron post	974.97
Corner Ts. 3 and 4 S., Rs. 3 and 4 W., iron post	1,038.289
Corner Ts. 4 and 5 S., Rs. 3 and 4 W., iron post	848.247
Corner Ts. 4 and 5 S., Rs. 4 and 5 W., iron post	820.107
Corner Ts. 4 and 5 S., Rs. 5 and 6 W., iron post	899.977
Corner Ts. 4 and 5 S., Rs. 6 and 7 W., iron post	894.199
Corner Ts. 4 and 5 S., Rs. 7 and 8 W., iron post	945.446
Standard corner T. 5 S., Rs. 6 and 7 W., iron post	913.225
Standard corner T. 5 S., Rs. 5 and 6 W., iron post	846.21
Standard corner T. 5 S., Rs. 4 and 5 W., iron post	797.39
Closing corner T. 6 S., Rs. 4 and 5 W., iron post	785.24
Standard corner T. 5 S., Rs. 3 and 4 W., iron post	847.62
Closing corner T. 6 S., Rs. 3 and 4 W., iron post	809.475
Chickasaw Nation, closing corner of fractional Ts. 4 and 5 S., R. 8 W., on the west boundary of, iron post	871.686
Chickasaw Nation, closing corner of the First Standard Parallel South, on the west boundary of the, and is in R. 8 W. of the Chickasaw Survey, iron post	904.44

ARDMORE QUADRANGLE.

The railroad levels were run by Mr. A. F. Hassan and Mr. R. Coe. Messrs. J. H. Carlock and H. L. Baker were attached to the subdivision and topographic party of Mr. C. W. Goodlove, while Mr. E. M. Fry was with Mr. R. A. Farmer's party and Mr. R. T. Carnall with Mr. J. Ahern's party. Mr. R. Coe had charge of an independent level party.

FROM OVERBROOK, NORTH ALONG GULF, COLORADO AND SANTA FE RAILWAY, TO DOUGHERTY.

	Feet.
Overbrook, 4½ miles south of; cross mark cut 8 inches from west edge of west coping of north pier of bridge 338, over Little Hickory Creek	667.978
Overbrook, ½ mile northwest of; iron post at standard corner T. 5 S., Rs. 1 and 2 E., and 1,300 feet west of railway	766.055

	Feet.
Overbrook, railroad spike in telegraph mile pole 443, near station	735.216
Ardmore, 1 mile south of; iron post at intersection of railway with township line, between Ts. 4 and 5 S., R. 2 E., near mile pole 449, and 30 feet west of center of track	861.795
Ardmore; bronze tablet in sandstone foundation of Noble Bros.' hardware store at southeast angle of railway crossing on Main street	872.443
Ardmore, 6 miles north of; iron post at intersection of railway with township line between Ts. 3 and 4 S., R. 2 E., in line with telegraph poles and 50 feet south of second pole west of track	708.829
Berwyn, 3 miles north of; copper bolt set in east side of coping stone of north pier of bridge No. 402, over Cool Creek, and near mile pole 464	752.335
Dougherty, 3,000 feet south of; railroad spike in mile pole 469	765.303
Dougherty, 2 miles north of; iron post at intersection of railway with township line between Ts. 1 and 2 S., R. 2 E., 30 feet left of track and 6 feet south of telegraph pole, 300 feet south of bridge 417, which is 3,000 feet south of mile pole 472	761.509

ALONG TOWNSHIP LINES.

Corner Ts. 1 and 2 S., Rs. 2 and 3 W., iron post	1,047.699
Corner Ts. 1 and 2 S., Rs. 1 and 2 W., iron post	1,171.609
Corner Ts. 1 and 2 S., Rs. 1 E. and 1 W., iron post	1,304.219
Corner Ts. 1 and 2 S., Rs. 1 and 2 E., iron post	1,090.649
Corner Ts. 1 and 2 S., Rs. 2 and 3 E., iron post	786.619
Corner Ts. 2 and 3 S., Rs. 2 and 3 E., iron post	808.912
Corner Ts. 2 and 3 S., Rs. 1 and 2 E., iron post	909.552
Corner Ts. 2 and 3 S., Rs. 1 E. and 1 W., iron post	912.862
Corner Ts. 2 and 3 S., Rs. 1 and 2 W., iron post	884.142
Corner Ts. 2 and 3 S., Rs. 2 and 3 W., iron post	1,034.067
Corner Ts. 3 and 4 S., Rs. 2 and 3 W., iron post	878.159
Corner Ts. 3 and 4 S., Rs. 1 and 2 W., iron post	927.469
Corner Ts. 3 and 4 S., Rs. 1 E. and 1 W., iron post	868.809
Corner Ts. 3 and 4 S., Rs. 1 and 2 E., iron post	748.669
Witness corner Ts. 3 and 4 S., Rs. 2 and 3 E., iron post	718.159
Corner Ts. 4 and 5 S., Rs. 2 and 3 E., iron post	890.745
Corner Ts. 4 and 5 S., Rs. 1 and 2 E., iron post	858.695
Corner Ts. 4 and 5 S., Rs. 1 E. and 1 W., iron post	950.605
Corner Ts. 4 and 5 S., Rs. 1 and 2 W., iron post	857.192
Corner Ts. 4 and 5 S., Rs. 2 and 3 W., iron post	991.032
Standard corner T. 5 S., Rs. 2 and 3 W., iron post	927.865
Closing corner T. 6 S., Rs. 2 and 3 W., iron post	930.73
Standard corner T. 5 S., Rs. 1 and 2 W., iron post	889.575
Closing corner T. 6 S., Rs. 1 and 2 W., iron post	902.27
Indian meridian, intersection of first standard parallel south with; iron post, Ts. 5 and 6 S., Rs. 1 E. and 1 W	818.369
Standard corner T. 5 S., Rs. 2 and 3 E., iron post	817.911

TISHOMINGO QUADRANGLE.

Mr. W. R. Manning had charge of an independent level party. Mr. H. L. Muldrow, jr., was attached to the subdivision and topographic party of Mr. R. H. McKee, and Mr. J. H. Carlock to that of Mr. C. W. Goodlove.

ALONG TOWNSHIP LINES.

	Feet.
Corner Ts. 1 and 2 S., Rs. 3 and 4 E., iron post	1,052.289
Corner Ts. 1 and 2 S., Rs. 4 and 5 E., iron post	1,035.779
Corner Ts. 1 and 2 S., Rs. 5 and 6 E., iron post	1,036.039
Corner Ts. 1 and 2 S., Rs. 6 and 7 E., iron post	967.079
Corner Ts. 1 and 2 S., Rs. 7 and 8 E., iron post	738.843
Corner Ts. 2 and 3 S., Rs. 7 and 8 E., iron post	782.572
Corner Ts. 2 and 3 S., Rs. 6 and 7 E., iron post	845.012
Corner Ts. 2 and 3 S., Rs. 5 and 6 E., iron post	891.322
Corner Ts. 2 and 3 S., Rs. 4 and 5 E.; bronze tablet set into township corner stone, which stone is a stone in place	903.212
Corner Ts. 2 and 3 S., Rs. 3 and 4 E., iron post	858.382
Corner Ts. 3 and 4 S., Rs. 3 and 4 E., iron post	779.049
Corner Ts. 3 and 4 S., Rs. 4 and 5 E., iron post	809.549
Corner Ts. 3 and 4 S., Rs. 5 and 6 E., iron post	694.599
Corner Ts. 3 and 4 S., Rs. 6 and 7 E., iron post	718.139
Corner Ts. 3 and 4 S., Rs. 7 and 8 E., iron post	726.319
Corner Ts. 4 and 5 S., Rs. 7 and 8 E., iron post	736.445
Corner Ts. 4 and 5 S., Rs. 6 and 7 E., iron post	598.755
Corner Ts. 4 and 5 S., Rs. 5 and 6 E., iron post	785.525
Corner Ts. 4 and 5 S., Rs. 4 and 5 E., iron post	793.075
Corner Ts. 4 and 5 S., Rs. 3 and 4 E., iron post	858.075
Standard corner T. 5 S., Rs. 3 and 4 E., iron post	730.03
Closing corner T. 6 S., Rs. 4 and 5 E., iron post	871.866
Standard corner T. 5 S., Rs. 4 and 5 E., iron post	860.106
Standard corner T. 5 S., Rs. 5 and 6 E., iron post	687.477
Standard corner T. 5 S., Rs. 6 and 7 E., iron post	754.815
Standard corner T. 5 S., Rs. 7 and 8 E., iron post	657.441

ATOKA QUADRANGLE.

The railroad levels were run by Messrs. G. A. Purington and W. R. Manning. Messrs. R. Coe and W. R. Manning were in charge of independent level parties. Mr. H. L. Muldrow, jr., was attached to the subdivision and topographic party of Mr. R. H. McKee.

FROM STRINGTOWN, ALONG THE MISSOURI, KANSAS AND TEXAS RAILWAY, TO ARMSTRONG.

	Feet.
Stringtown, ½ mile south of; elm, 10 inches in diameter, 100 feet left of track and 1,000 feet south of mile pole 603	594.604
Atoka, ½ mile north of; copper bolt sunk into second coping stone from east side of north pier of bridge 367, over Muddy Boggy Creek	540.375
Peck; nail in black-jack oak, 14 inches diameter, 40 feet left of track and 350 feet south of mile pole 615	616.096
Caney, ½ mile north of; copper bolt sunk into first step of west side of south abutment of bridge 388, 500 feet south of mile pole 621	517.217
Caddo, 2 miles north of; copper bolt sunk into second coping stone from east side of south abutment of bridge 403, 1,800 feet north of mile pole 627	591.561
Armstrong; copper bolt sunk into first coping stone from north edge of north abutment of bridge 421, over Blue River, 600 feet north of the Armstrong switch	567.491

ON COALGATE BRANCH OF THE MISSOURI, KANSAS AND TEXAS RAILWAY.

	Feet.
Midway; spike in mile pole 5	598.213
Lehigh; bronze tablet set into stone of first layer of foundation near northeast corner of building owned by Joe. Grillery, and situated at the southwest corner of Main street and "Wild-Cat Row."	593.319

ALONG TOWNSHIP LINES.

Chickasaw-Choctaw boundary line, closing corner of Ts. 1 and 2 S., R. 8 E., of the Chickasaw survey on the, iron post	666.993
Chickasaw-Choctaw boundary line, closing corner of Ts. 1 and 2 S., R. 8 E., of the Choctaw survey on the, iron post	666.583
Corner Ts. 1 and 2 S., Rs. 8 and 9 E., iron post	619.730
Corner Ts. 1 and 2 S., Rs. 9 and 10 E., iron post	595.571
Corner Ts. 1 and 2 S., Rs. 10 and 11 E., iron post	591.614
Corner Ts. 1 and 2 S., Rs. 11 and 12 E., iron post	597.76
Corner Ts. 2 and 3 S., Rs. 11 and 12 E., iron post	598.236
Corner Ts. 2 and 3 S., Rs. 10 and 11 E., iron post	633.062
Corner Ts. 2 and 3 S., Rs. 9 and 10 E., iron post	533.652
Corner Ts. 2 and 3 S., Rs. 8 and 9 E., iron post	635.382
Chickasaw-Choctaw boundary line, closing corner of Ts. 2 and 3 S., R. 8 E., of the Choctaw Survey on the, iron post	706.202
Chickasaw-Choctaw boundary line, closing corner of Ts. 2 and 3 S., R. 8 E., of the Chickasaw Survey on the, iron post	764.102
Chickasaw-Choctaw boundary line, closing corner of Ts. 3 and 4 S., R. 8 E., of the Chickasaw Survey on the, iron post	653.499
Chickasaw-Choctaw boundary line, closing corner of Ts. 3 and 4 S., R. 8 E., of the Choctaw Survey on the, iron post	651.659
Corner Ts. 3 and 4 S., Rs. 8 and 9 E., iron post	718.542
Corner Ts. 3 and 4 S., Rs. 9 and 10 E., iron post	688.987
Corner Ts. 3 and 4 S., Rs. 10 and 11 E., iron post	502.994
Corner Ts. 3 and 4 S., Rs. 11 and 12 E., iron post	557.629
Standard corner T. 4 S., Rs. 11 and 12 E., iron post	522.542
Closing corner T. 5 S., Rs. 11 and 12 E., iron post	502.902
Standard corner T. 4 S., Rs. 10 and 11 E., iron post	642.252
Closing corner T. 5 S., Rs. 10 and 11 E., iron post	648.057
Standard corner T. 4 S., Rs. 9 and 10 E., iron post	632.257
Closing corner T. 5 S., Rs. 9 and 10 E., iron post	630.217
Standard corner Ts. 4 and 5 S., Rs. 8 and 9 E., intersection of 1st standard parallel south with the 2d guide meridian east; iron post	600.287
Chickasaw-Choctaw boundary line, closing corner Ts. 4 and 5 S., R. 8 E., of the Choctaw Survey on the, iron post	668.287
Chickasaw-Choctaw boundary line, closing corner Ts. 4 and 5 S., R. 8 E., of the Chickasaw Survey on the, iron post	669.107
Chickasaw-Choctaw boundary line, closing corner Ts. 5 and 6 S., R. 8 E., of the Chickasaw and Choctaw Surveys on the, iron post	708.947
Corner Ts. 5 and 6 S., Rs. 8 and 9 E., iron post	632.16
Corner Ts. 5 and 6 S., Rs. 9 and 10 E., iron post	634.25
Corner Ts. 5 and 6 S., Rs. 10 and 11 E., iron post	604.015
Corner Ts. 5 and 6 S., Rs. 11 and 12 E., iron post	714.355

ANTLERS QUADRANGLE.

Mr. H. C. McCluer ran the railroad levels. Messrs. Robert Coe, R. T. Carnall, and F. E. Fellows had independent level parties, while Mr. W. P. Halliday was attached to the topographic and subdivision party of Mr. W. S. Post.

ALONG THE ST. LOUIS AND SAN FRANCISCO RAILROAD FROM BUTLER TO GOODLAND.

	Feet.
Butler; elm, 14 inches diameter, 140 feet left of track and 400 feet south of mile pole 522	528.466
Wadena, ½ mile north of; square hole cut into west end of south abutment of bridge	491.285
Wadena; elm, 10 inches diameter, 90 feet left of track and 200 feet south of milepost 527	485.725
Kosoma, ½ mile south of; post oak, 12 inches diameter, 60 feet right of track and 1,700 feet south of mile pole 531	483.196
Rodney; post oak, 10 inches diameter, 90 feet left and 600 feet south of mile pole 537	468.436
Davenport, ½ mile south of; red oak, 15 inches in diameter, 100 feet left of track and opposite mile pole 539	474.286
Antlers; square hole cut into section corner stone, common to secs. 3, 4, 9, and 10, T. 4 S., R. 16 E.; 28 feet north of the northwest corner of the Antlers court-house building	508.856
Antlers, 4 miles south of; black-jack, 8 inches diameter, 100 feet right of track and 175 feet south of mile pole 546	558.753
Hamden; red oak, 24 inches diameter, 60 feet right of track and 50 feet east of mile pole 549	464.561
Goodland, 2 miles north of; red oak, 20 inches diameter, 60 feet right of track and 275 feet south of mile pole 554	494.116
Goodland, 1,000 feet north of station; elm tree, 6 inches in diameter, 60 feet right of track and 120 feet north of mile pole 556	491.969

ALONG TOWNSHIP LINES.

Corner Ts. 1 and 2 S., Rs. 12 and 13 E., iron post	724.63
Corner Ts. 1 and 2 S., Rs. 13 and 14 E., iron post	842.345
Corner Ts. 1 and 2 S., Rs. 14 and 15 E., iron post	943.7
Corner Ts. 1 and 2 S., Rs. 15 and 16 E., bronze tablet set into township corner stone, which is a "stone in place"	697.505
Corner Ts. 1 and 2 S., Rs. 16 and 17 E., iron post	665.505
Corner Ts. 2 and 3 S., Rs. 16 and 17 E., iron post	618.038
Corner Ts. 2 and 3 S., Rs. 15 and 16 E., iron post	812.5
Corner Ts. 2 and 3 S., Rs. 14 and 15 E., iron post	663.111
Corner Ts. 2 and 3 S., Rs. 13 and 14 E., iron post	580.896
Corner Ts. 2 and 3 S., Rs. 12 and 13 E., iron post	605.221
Corner Ts. 3 and 4 S., Rs. 12 and 13 E., iron post	568.509
Corner Ts. 3 and 4 S., Rs. 13 and 14 E., iron post	497.184
Corner Ts. 3 and 4 S., Rs. 14 and 15 E., iron post	622.234
Corner Ts. 3 and 4 S., Rs. 15 and 16 E., iron post	565.504
Corner Ts. 3 and 4 S., Rs. 16 and 17 E., iron post	453.518
Standard corner T. 4 S., Rs. 16 and 17 E., iron post	468.94

	Feet.
Closing corner T. 5 S., Rs. 16 and 17 E., iron post	503.77
Standard corner T. 4 S., Rs. 15 and 16 E., iron post	629.9
Closing corner T. 5 S., Rs. 15 and 16 E., iron post	620.755
Standard corner T. 4 S., Rs. 14 and 15 E., iron post	574.565
Closing corner T. 5 S., Rs. 14 and 15 E., iron post	531.42
Standard corner T. 4 S., Rs. 13 and 14 E., iron post	544.27
Closing corner T. 5 S., Rs. 13 and 14 E., iron post	531.81
Standard corner T. 4 S., Rs. 12 and 13 E., iron post	465.49
Closing corner T. 5 S., Rs. 12 and 13 E., iron post	465.755
Corner Ts. 5 and 6 S., Rs. 12 and 13 E., iron post	729.39
Corner Ts. 5 and 6 S., Rs. 13 and 14 E., iron post	523.99
Corner Ts. 5 and 6 S., Rs. 14 and 15 E., iron post	481.75
Corner Ts. 5 and 6 S., Rs. 15 and 16 E., iron post	516.25
Corner Ts. 5 and 6 S., Rs. 16 and 17 E., iron post	532.27

ALIKCHI QUADRANGLE.

Messrs. F. E. Fellows and V. T. Rhyne had charge of independent level parties. Messrs. F. E. Fellows and W. P. Halliday were attached for a time to the topographic and subdivision party of Mr. Oscar Jones, after which time Messrs. W. P. Halliday, Oscar Jones, and G. H. Bartlett were attached to the party under charge of Mr. W. S. Post.

ALONG TOWNSHIP LINES.

	Feet.
Corner Ts. 1 and 2 S., Rs. 17 and 18 E., iron post	567.905
Corner Ts. 1 and 2 S., Rs. 18 and 19 E., iron post	1,039.672
Corner Ts. 1 and 2 S., Rs. 19 and 20 E., iron post	813.882
Corner Ts. 1 and 2 S., Rs. 20 and 21 E., iron post	746.935
Corner Ts. 1 and 2 S., Rs. 21 and 22 E., iron post	947.3
Corner Ts. 2 and 3 S., Rs. 21 and 22 E., iron post	1,253.769
Corner Ts. 2 and 3 S., Rs. 20 and 21 E., iron post	592.811
Corner Ts. 2 and 3 S., Rs. 19 and 20 E., iron post	701.59
Corner Ts. 2 and 3 S., Rs. 18 and 19 E., iron post	973.502
Corner Ts. 2 and 3 S., Rs. 17 and 18 E., iron post	504.559
Corner Ts. 3 and 4 S., Rs. 17 and 18 E., iron post	692.986
Corner Ts. 3 and 4 S., Rs. 18 and 19 E., iron post	609.242
Corner Ts. 3 and 4 S., Rs. 19 and 20 E., iron post	845.637
Corner Ts. 3 and 4 S., Rs. 20 and 21 E., iron post	529.173
Corner Ts. 3 and 4 S., Rs. 21 and 22 E., iron post	700.452
Standard corner T. 4 S., Rs. 21 and 22 E., iron post	560.001
Closing corner T. 5 S., Rs. 21 and 22 E., iron post	527.005
Standard corner T. 4 S., Rs. 20 and 21 E., iron post	533.719
Closing corner T. 5 S., Rs. 20 and 21 E., iron post	546.338
Standard corner T. 4 S., Rs. 19 and 20 E., iron post	693.813
Closing corner T. 5 S., Rs. 19 and 20 E., iron post	681.673
Standard corner T. 4 S., Rs. 18 and 19 E., iron post	459.434
Closing corner T. 5 S., Rs. 18 and 19 E., iron post	466.257
Standard corner T. 4 S., Rs. 17 and 18 E., iron post	412.346
Closing corner T. 5 S., Rs. 17 and 18 E., iron post	414.285
Corner Ts. 5 and 6 S., Rs. 17 and 18 E., iron post	411.973
Corner Ts. 5 and 6 S., Rs. 18 and 19 E., iron post	434.619
Corner Ts. 5 and 6 S., Rs. 19 and 20 E., iron post	433.384
Corner Ts. 5 and 6 S., Rs. 20 and 21 E., iron post	606.513
Corner Ts. 5 and 6 S., Rs. 21 and 22 E., iron post	390.505

EAGLETOWN QUADRANGLE.

Mr. F. E. Fellows had charge of an independent level party. Messrs. W. P. Halliday, Oscar Jones, and G. H. Bartlett were attached to the topographic and subdivision party of Mr. W. S. Post.

ALONG TOWNSHIP LINES.

	Feet.
Corner Ts. 1 and 2 S., Rs. 22 and 23 E., iron post	779.16
Corner Ts. 1 and 2 S., Rs. 23 and 24 E., iron post	1,090.1
Corner Ts. 1 and 2 S., Rs. 24 and 25 E., iron post	960.52
Corner Ts. 1 and 2 S., Rs. 25 and 26 E., iron post	758.12
Corner Ts. 1 and 2 S., Rs. 26 and 27 E., iron post	1,020.309
Corner Ts. 2 and 3 S., Rs. 26 and 27 E., iron post	1,171.796
Corner Ts. 2 and 3 S., Rs. 25 and 26 E., iron post	1,045.613
Corner Ts. 2 and 3 S., Rs. 24 and 25 E., iron post	889.602
Corner Ts. 2 and 3 S., Rs. 23 and 24 E., iron post	944.902
Corner Ts. 2 and 3 S., Rs. 22 and 23 E., iron post	739.749
Corner Ts. 3 and 4 S., Rs. 22 and 23 E., iron post	743.173
Corner Ts. 3 and 4 S., Rs. 23 and 24 E., iron post	818.562
Corner Ts. 3 and 4 S., Rs. 24 and 25 E., iron post	685.697
Corner Ts. 3 and 4 S., Rs. 25 and 26 E., iron post	629.396
Corner Ts. 3 and 4 S., Rs. 26 and 27 E., iron post	1,086.588
Standard corner T. 4 S., Rs. 26 and 27 E., iron post	806.891
Closing corner T. 5 S., Rs. 26 and 27 E., iron post	827.648
Standard corner T. 4 S., Rs. 25 and 26 E., iron post	644.931
Closing corner T. 5 S., Rs. 25 and 26 E., iron post	590.208
Standard corner T. 4 S., Rs. 24 and 25 E., iron post	757.441
Closing corner T. 5 S., Rs. 24 and 25 E., iron post	681.951
Standard corner T. 4 S., Rs. 23 and 24 E., iron post	751.146
Closing corner T. 5 S., Rs. 23 and 24 E., iron post	738.316
Standard corner T. 4 S., Rs. 22 and 23 E., iron post	641.631
Closing corner T. 5 S., Rs. 22 and 23 E., iron post	749.346
Corner Ts. 5 and 6 S., Rs. 22 and 23 E., iron post	459.675
Corner Ts. 5 and 6 S., Rs. 23 and 24 E., iron post	492.322
Corner Ts. 5 and 6 S., Rs. 24 and 25 E., iron post	469.285
Corner Ts. 5 and 6 S., Rs. 25 and 26 E., iron post	449.933
Corner Ts. 5 and 6 S., Rs. 26 and 27 E., iron post	485.451

The following bench mark is situated just east of the Eagletown quadrangle:

	Feet.
Arkansas-Choctaw boundary line closing corner, first standard parallel south, between Ts. 4 and 5 S., R. 27 E., on the cross on stone corner	733.421

SHAWNEETOWN QUADRANGLE (INDIAN TERRITORY-TEXAS).

Levels were run by G. H. Bartlett, W. P. Halliday, F. E. Fellows, and O. Jones, who were attached to the subdivision and topographic party of Mr. W. S. Post, who was relieved by Mr. W. T. Turner.

ALONG TOWNSHIP AND SECTION LINES.

	Feet.
Corner Ts. 6 and 7 S., Rs. 22 and 23 E., iron post	401.319
Corner Ts. 6 and 7 S., Rs. 23 and 24 E., iron post	396.409
Corner Ts. 6 and 7 S., Rs. 24 and 25 E., iron post	358.914
Corner Ts. 6 and 7 S., Rs. 25 and 26 E., iron post	388.382

	Feet.
Corner Ts. 6 and 7 S., Rs. 26 and 27 E., iron post	328.016
Corner Ts. 7 and 8 S., Rs. 26 and 27 E., iron post	396.312
Corner Ts. 7 and 8 S., Rs. 25 and 26 E., iron post	342.216
Corner Ts. 7 and 8 S., Rs. 24 and 25 E., iron post	445.319
Corner Ts. 7 and 8 S., Rs. 23 and 24 E., iron post	503.722
Corner Ts. 7 and 8 S., Rs. 22 and 23 E., iron post	417.355
Red River, meander corner T. 8 S., Rs. 22 and 23 E., secs. 19 and 24, left bank of; mulberry 12 inches in diameter, which is northeast, bearing tree to meander corner	364.527
Closing corner T. 9 S., Rs. 23 and 24 E., iron post	356.274
Standard corner T. 8 S., Rs. 23 and 24 E., iron post	351.224
Closing corner T. 9 S., Rs. 24 and 25 E., iron post	409.992
Standard corner T. 8 S., Rs. 24 and 25 E., iron post	382.407
Closing corner T. 9 S., Rs. 25 and 26 E., iron post	411.275
Standard corner T. 8 S., Rs. 25 and 26 E., iron post	420.808
Closing corner T. 9 S., Rs. 26 and 27 E., iron post	400.427
Standard corner T. 8 S., Rs. 26 and 27 E., iron post	400.257
Corner Ts. 9 and 10 S., Rs. 26 and 27 E., iron post	352.027
Corner Ts. 9 and 10 S., Rs. 25 and 26 E., iron post	333.172
Witness corner Ts. 9 and 10 S., Rs. 24 and 25 E., iron post	337.089
Red River, Harris Ferry; 850 feet south of, witness corner to Ts. 9 and 10 S., Rs. 24 and 25 E., on root of bois d'arc tree 16 inches in diameter, left bank of	341.933
Red River, meander corner, T. 9 S., Rs. 23 and 24 E., secs. 25 and 30, left bank of; iron post	350.129

The following bench marks are just east of the Shawneetown quadrangle:

	Feet.
Arkansas-Choctaw boundary, closing corner, Ts. 7 and 8 S., R. 27 E., on the; iron post	400.48
Arkansas-Choctaw boundary, closing corner, second standard parallel south, between Ts. 8 and 9 S., R. 27 E., on the, nail in root of bearing tree	393.655

CLARKSVILLE QUADRANGLE (INDIAN TERRITORY-TEXAS.)

Mr. H. C. McCluer ran the railroad levels. Mr. J. H. Carlock had an independent level party. Messrs. W. P. Halliday and O. Jones were attached to the subdivision and topographic party of Mr. W. S. Post.

ON THE ST. LOUIS AND SAN FRANCISCO RAILROAD.

	Feet.
Arthur, Texas, ½ mile north of; copper bolt set into east coping stone of north abutment of bridge 440	419.993

ALONG TOWNSHIP AND SECTION LINES.

Corner Ts. 6 and 7 S., Rs. 17 and 18 E., iron post	513.862
Corner Ts. 6 and 7 S., Rs. 18 and 19 E., iron post	389.569
Corner Ts. 6 and 7 S., Rs. 19 and 20 E., iron post	397.683
Corner Ts. 6 and 7 S., Rs. 20 and 21 E., iron post	451.967
Corner Ts. 6 and 7 S., Rs. 21 and 22 E., iron post	470.476

	Feet.
Red River, meander corner between sec. 13, T. 7 S., R. 20 E., and sec. 18, T. 7 S., R. 21 E.; iron post on left bank of	375.954
Red River, meander corner between sec. 35, T. 7 S., R. 19 E., and sec. 2, T. 8 S., R. 19 E.; iron post on left bank of	394.841
Corner Ts. 7 and 8 S., Rs. 18 and 19 E., iron post	483.711
Corner Ts. 7 and 8 S., Rs. 17 and 18 E., iron post	414.561

PARIS QUADRANGLE (INDIAN TERRITORY-TEXAS).

The railroad levels were run by Mr. H. C. McCluer. Mr. J. H. Carlock had an independent level party.

FROM GRANT, INDIAN TERRITORY, ALONG THE ST. LOUIS AND SAN FRANCISCO RAILROAD, TO PARIS, TEXAS.

	Feet.
Grant, ¼ mile south of; red oak 8 inches in diameter, 50 feet right of track, 35 feet south of mile pole 564	463.98
Lenoir; post oak 8 inches in diameter, 40 feet left of track and 350 feet south of mile pole 573	526.319
Paris; spike in telegraph pole, 90 feet east of St. Louis and San Francisco Railroad, and 20 feet south of Texas and Pacific Railway	542.762

FROM BROOKSTON, TEXAS, ALONG THE TEXAS AND PACIFIC RAILWAY, TO HONEY GROVE, TEXAS.

Brookston; spike in mile pole 100	588.023
Petty, ½ mile west of; spike in mile pole 107	636.57
Honey Grove; copper bolt set into bottom step of the approach to First National Bank, corner of Fifth and Market streets	675.221

ALONG TOWNSHIP AND SECTION LINES.

Corner Ts. 6 and 7 S., Rs. 12 and 13 E., iron post	594.912
Corner Ts. 6 and 7 S., Rs. 13 and 14 E., iron post	602.772
Corner Ts. 6 and 7 S., Rs. 14 and 15 E., iron post	534.482
Corner Ts. 6 and 7 S., Rs. 15 and 16 E., iron post	484.372
Corner Ts. 6 and 7 S., Rs. 16 and 17 E., iron post	501.202
Red River, meander corner between sec. 32, T. 7 S., and sec. 5, T. 8 S., R. 17 E.; iron post on left bank of	412.291

BONHAM QUADRANGLE (INDIAN TERRITORY-TEXAS).

Messrs. W. R. Manning and H. C. McCluer ran the railroad levels. Messrs. J. H. Carlock and W. R. Manning had charge of independent level parties. Messrs. H. L. Baker and J. H. Carlock were attached to the subdivision and topographic party of Mr. C. W. Goodlove.

FROM DURANT, ALONG MISSOURI, KANSAS AND TEXAS RAILWAY, TO COLBERT.

	Feet.
Durant, ⅖ mile south of; copper bolt set in second coping stone from the west, 1.7 feet from the north edge and 3.3 feet from the west edge of first coping stone of the north abutment of bridge 430, over the Mineral Bayou	619.292

	Feet.
Cale, about 2,000 feet north of station; railroad spike in telegraph mile pole 646	694.573
Colbert, about 1,000 feet north of station; railroad spike in telegraph mile pole 653	661.696

FROM WINDOM, TEXAS, ALONG TEXAS AND PACIFIC RAILWAY, TO BELLS, TEXAS.

Windom; railroad spike in mile pole 117	691.938
Dodd City, about 3,000 feet east of station; railroad spike in bois d'arc tree, 10 inches in diameter, 75 feet right of track and 540 feet west of mile pole 121	645.772
Bonham, 1 mile east of; railroad spike in telegraph pole 180 feet west of mile pole 126	545.606
Ector, 2,500 feet east of station; railroad spike in mile pole 133	661.514
Savoy, 700 feet east of; spike in mile pole 139	673.137
Bells; railroad spike in mile pole 142	677.219

ALONG TOWNSHIP LINES.

Chickasaw-Choctaw boundary line, closing corner Ts. 6 and 7 S., R. 8 E., of the Choctaw survey on the, iron post	717.756
Corner Ts. 6 and 7 S., Rs. 8 and 9 E., iron post	668.435
Corner Ts. 6 and 7 S., Rs. 9 and 10 E., iron post	625.552
Corner Ts. 6 and 7 S., Rs. 10 and 11 E., iron post	565.822
Corner Ts. 6 and 7 S., Rs. 11 and 12 E., iron post	584.062
Chickasaw-Choctaw boundary line, closing corner Ts. 7 and 8 S., R. 8 E., of Chickasaw survey, on the, which is Island Bayou at this point; iron post	619.337
Corner Ts. 8 and 9 S., Rs. 8 and 9 E., iron post	624.766
Corner Ts. 8 and 9 S., Rs. 9 and 10 E., iron post	641.586
Corner Ts. 8 and 9 S., Rs. 10 and 11 E., iron post	494.096

DENISON QUADRANGLE (INDIAN TERRITORY-TEXAS).

The railroad levels were run by Messrs. W. R. Manning, H. C. McClucr, R. T. Carnall, and A. F. Hassan. Mr. J. H. Carlock was attached to the subdivision and topography party of Mr. C. W. Goodlove, which did the Indian Territory portion of the quadrangle, and Mr. A. F. Hassan ran primary and secondary levels for Mr. J. Ahern's topographic party, which worked the Texas portion.

ALONG TOWNSHIP AND SECTION LINES.

	Feet.
Corner Ts. 6 and 7 S., Rs. 3 and 4 E., iron post	662.168
Corner Ts. 6 and 7 S., Rs. 4 and 5 E., iron post	761.047
Corner Ts. 6 and 7 S., Rs. 5 and 6 E., iron post	749.797
Corner Ts. 6 and 7 S., Rs. 6 and 7 E., iron post	583.907
Corner Ts. 6 and 7 S., Rs. 7 and 8 E., iron post	684.317
Corner Ts. 7 and 8 S., Rs. 7 and 8 E., iron post	668.517
Red River, meander corner on, T. 7 S., R. 7 E., sec. 33, and T. 8 S., R. 7 E., sec. 4; on stone	542.117
Red River, meander corner on, between T. 7 S., R. 6 E., sec. 33, and T. 8 S., R. 6 E., sec. 4; on stone	549.631

	Feet.
Corner Ts. 7 and 8 S., Rs. 5 and 6 E., iron post	725.621
Corner Ts. 7 and 8 S., Rs. 4 and 5 E., iron post	721.271
Red River, meander corner on, between T. 7 S., R. 4 E., sec. 33, and T. 8 S., R. 4 E., sec. 4; on stone	568.861
Red River, meander corner on, between T. 7 S., R. 4 E., sec. 7, and T. 7 S., R. 3 E., sec. 12; iron post	592.958
Red River, meander corner on, between T. 7 S., R. 3 E., sec. 34, and T. 8 S., R. 3 E., sec. 3; on stone	604.726
Red River, meander corner on, between T. 8 S., R. 4 E., sec. 12, and T. 8 S., R. 4 E., sec. 7; iron post	576.62
Red River, meander corner on, between T. 8 S., R. 5 E., sec. 25, and T. 8 S., R. 6 E., 8 sec. 30; iron post	561.021
Red River, meander corner on, between T. 8 S., R. 8 E., sec. 31, and T. 9 S., R. 8 E., sec. 6; iron post	529.316

FROM COLBERT, INDIAN TERRITORY, ALONG THE MISSOURI, KANSAS AND TEXAS RAILWAY, TO SHERMAN, TEXAS.

Colbert, Indian Territory, 2¾ miles south of; copper bolt set in first step of the north abutment of bridge over Red River, No. 451. The bolt is 1.3 feet from the north edge, 1 foot from the south edge, and 0.9 foot from the west edge	550.105
Denison, Texas; bronze tablet set in center of base stone of granite foundation of the Ford Building, on left of avenue entrance. The building is situated at corner of Main street and Rusk avenue, and is occupied by the National Bank of Denison and numerous offices	735.831
Cook Spring, Texas, near station; railroad spike in fifth telegraph pole south of mile-pole 666	641.821
Sherman, Texas; bronze tablet set in first course of stone foundation, 5.2 feet from south edge of stone, 5.8 feet from north edge of stone, and on the left side of main entrançe to the Fire Department. The building is situated on the corner of Travis and Cherry streets	728.294

FROM CHOCTAW, TEXAS, WEST ALONG TEXAS AND PACIFIC RAILWAY, TO SOUTHMAYD, TEXAS.

Choctaw, Grayson County, about 1 mile west of; on anchor bolt at northeast corner of shoe of angle brace, on north side of bridge 72, over Choctaw Creek	578.262
Southmayd, Grayson County, 5 miles east of; iron post set 20 feet and 9 inches south of mile pole 160, and 48 feet and 3 inches south of center of Texas and Pacific track, and 249 feet west of road crossing	835.166
Southmayd, Grayson County; iron post set 9 feet south of mile pole 165, which pole is the fourth one west of station, and is 46 feet south of center of Texas and Pacific track	742.202

ALONG THE JOINT LINE OF TEXAS AND PACIFIC AND MISSOURI, KANSAS AND TEXAS RAILROADS.

Collinsville, Grayson County; iron post set 50 feet south of frog of switch, and 5 feet 10 inches east of center of track	745.504

FROM ETHEL, GRAYSON COUNTY, TEXAS, EAST ALONG COUNTY ROADS, TO HOWE, GRAYSON COUNTY, TEXAS.

	Feet.
Ethel, Grayson County; iron post set in the northeast corner of intersection of roads and on inside of fence	723.969
Ethel, Grayson County, about 6¼ miles east of; iron post set in northeast corner of intersection of the Sherman and Tioga road with the Sherman and Howe road, on the inside of fence	713.036
Howe, Grayson County, about 6⅕ miles west of; iron post set inside of fence at northeast corner of intersection of roads at William Chisholm's home	816.682
Howe, Grayson County; iron post set 19 feet 6 inches west of center of Houston and Texas Central Railroad and 49 feet 6 inches north of northeast corner of station building	841.264
Howe, Grayson County, about ⅘ mile south of; lead bolt in stone underneath the triangulation signal at Howe	877.515

ON HOUSTON AND TEXAS CENTRAL RAILROAD.

Sherman, Grayson County, 4 miles south of; copper bolt in lower coping stone west side of south abutment of bridge over Choctaw Creek	652.519

FROM SHERMAN, GRAYSON COUNTY, TEXAS, ALONG COUNTY ROAD NORTH TO POTTSBORO, GRAYSON COUNTY, TEXAS; THEN WEST TO DEXTER, COOKE COUNTY, TEXAS; THEN SOUTH TO WHITESBORO, GRAYSON COUNTY, TEXAS.

Pottsboro, Grayson County, 4¾ miles south of; copper bolt in stone underneath triangulation signal "Good"	881.225
Pottsboro, Grayson County, 6½ miles west of; iron post set in southeast corner of Mrs. Carrie Nicholas's front yard and 285 feet north of center of the Pottsboro-Gordonville road	714.245
Gordonville, Grayson County; iron post south of Sanderson's drug store, east of post-office, and 33 feet south of center of road, on widow Gordon's place, and nearly south of old well in roadway	719.345
Dexter, Cooke County, ¾ mile east of; iron post set in front garden of J. F. Evans, at a distance of 62.5 feet south of southwest corner of Evans's house and 63 feet north of center of main road, and about 200 feet west of the county line between Cooke and Grayson counties	835.985
Dexter, Cooke County; cross mark cut in the foundation stone at the southwest corner of J. F. Cochran's store. The building is owned by Mrs. T. H. Williams	779.515
Dexter, Cooke County, ½ mile north of; copper bolt in stone underneath "Dexter" triangulation station	861.8
Dexter, Cooke County, 5½ miles south of; iron post set at turn of road eastward around M. A. Goldston's pasture and about 1,165 feet south of house which is owned by the Carlock heirs and occupied by Mr. Stuckey. Bench mark on inside of fence	793.71
County line, Cooke County, 1⅜ miles west of; copper bolt in stone underneath "County line" triangulation signal	882.345
Whitesboro, Grayson County, 3⅗ miles west of; iron post at intersection of the Dexter road with the Gainesville-Whitesboro road, set in the corner of Dr. Younger's yard and across the road from Nance Prairie school	772.215

FROM SOUTHMAYD, GRAYSON COUNTY, TEXAS, SOUTHEAST ON COUNTY ROAD TO MORMON GROVE, GRAYSON COUNTY, TEXAS, THEN NORTHEAST TO SHERMAN, TEXAS.

	Feet.
Southmayd, Grayson County, 6¼ miles southeast of; iron post about 1¼ miles south of Valley Summit School and set in Halliday's field, across the road from Mrs. Keene's pasture. It is about 20 feet east of the center of road and 2 feet north of division fence, while the head of a timbered drain flowing southwest is 600 feet north	758.61
Mormon Grove, Grayson County, 550 feet northeast of; cross mark cut in stone underneath "Mormon Grove" triangulation station. The copper bolt in the stone is about 2 feet under the surface, and was put there by the triangulation party	899.255
Sherman, Grayson County, 3 miles southwest of; iron post set on inside of fence at a turn of the road to the east and directly opposite a gate on the other side of the lane	799.985

ALONG COUNTY ROAD FROM POTTSBORO, GRAYSON COUNTY, TEXAS, TO MEANDER CORNER ON RED RIVER OF T. 8 S., RS. 5 AND 6 E., OF THE CHICKASAW SURVEY.

Fink, Grayson County; iron post set inside of fence, 24 feet north of road to Bounds Ferry and just west of the post-office	708.715
Fink, Grayson County, 2 miles west of; copper bolt in stone underneath "Fink" triangulation station	837.92

DENISON, TEXAS.

Iron post at headquarters of the United States Geological Survey, Indian Territory division, on the corner of Texas street and Austin avenue. The post is set in the front yard, near the gate opening on Texas street, the property being known as "The Stuart place"	755.355

ALONG THE MISSOURI, KANSAS AND TEXAS RAILWAY, FROM POTTSBORO, TEXAS, WEST TO WOODBINE, TEXAS.

Pottsboro, Grayson County; bronze tablet set in foundation stone of southwest corner of brick and stone building owned and occupied by J. E. Reeves	765.919
Steedman, Grayson County; iron post, 1 foot above the surface, 50 feet south of track and 100 feet east of the section house at Steedman. Name of railroad station is Deaver	630.123
Whitesboro, Grayson County; bronze tablet, 3.5 feet above ground and 15 inches from southeast corner on east side of brick school building at Whitesboro	819.764
Woodbine, Grayson County, 2 miles east of; cross mark cut on southwest end of coping stone on south side of east end bridge over Timber Creek and about 30 feet from mile-pole 691	697.764

GAINESVILLE QUADRANGLE (TEXAS-INDIAN TERRITORY).

The railroad levels were run by Messrs. R. T. Carnall and R. Coe. Mr. J. H. Carlock was attached to the topographic and subdivision party of Mr. C. W. Goodlove, and Mr. R. T. Carnall was with Mr. J. Ahern's party.

GAINESVILLE, TEXAS.

	Feet.
Bronze tablet set in center of north face of top foundation stone at northeast corner of brick building on California street, near station building, and used by Tyler & Simpson as a grocery store	733.159
Iron post, 2 inches out of ground, 45.3 feet south of south crossing frog, and in line with north and south crossing frogs of the Missouri, Kansas and Texas Railway with the Gulf, Colorado and Santa Fe Railway. It is 6.4 feet west of west rail of Missouri, Kansas and Texas and 6.8 feet east of east rail of Gulf, Colorado and Santa Fe	740.188

FROM GAINESVILLE, TEXAS, ALONG GULF, COLORADO AND SANTA FE RAILWAY TO MARIETTA, INDIAN TERRITORY.

Gainesville, Texas, 6 miles north of; copper bolt set about middle of coping stone on east side of north pier of bridge over Red River	660.541
Thackerville, Indian Territory, 1 mile north of; railroad spike in first telegraph pole north of mile pole 424	880.606
Bomer, Indian Territory, railroad spike in telegraph mile pole 428	826.439
Marietta, Indian Territory, bronze tablet set about the middle of east face of second stone above foundation at northeast corner of two-story stone building owned by S. S. Evants and used by him as a general store	844.640

ALONG TOWNSHIP AND SECTION LINES.

Corner Ts. 6 and 7 S., Rs. 2 and 3 W., iron post	921.010
Corner Ts. 6 and 7 S., Rs. 1 and 2 W., iron post	770.248
Corner Ts. 6 and 7 S., Rs. 1 W. and 1 E., iron post	917.328
Corner Ts. 6 and 7 S., Rs. 1 and 2 E., iron post	796.318
Corner Ts. 6 and 7 S., Rs. 2 and 3 E., iron post	662.478
Corner Ts. 7 and 8 S., Rs. 2 and 3 E., iron post	737.336
Corner Ts. 7 and 8 S., Rs. 1 and 2 E., iron post	779.936
Red River, meander corner on, between sec. 34, T. 7 S., R. 1 E. and sec. 3, T. 8 S., R. 1 E., on stone	670.696
Red River, meander corner on, between sec. 31, T. 7 S., R. 1 E., and sec. 36, T. 7 S., R. 1 W., on stone	675.968
Red River, meander corner on, between sec. 36, T. 7 S., R. 1 W., and sec. 1, T. 8 S., R. 1 W., iron post	677.483
Corner Ts. 7 and 8 S., Rs. 1 and 2 W., iron post	827.208
Red River, meander corner on, between sec. 31, T. 7 S., R. 2 W., and sec. 6, T. 8 S., R. 2 W., iron post	720.700
Red River, meander corner on, between sec. 31, T. 7 S., R. 2 W., and sec. 36, T. 7 S., R. 3 W., iron post	722.500
Red River, meander corner on, between sec. 13, T. 8 S., R. 2 W., and sec. 18, T. 8 S., R. 1 W., iron post	696.800
Red River, meander corner on, between sec. 34, T. 8 S., R. 1 E., and sec. 3, T. 9 S., R. 1 E., on stone	658.536
Corner Ts. 8 and 9 S., Rs. 1 and 2 E., iron post	664.556
Red River, meander corner on, between sec. 34, T. 8 S., R. 2 E., and sec. 3, T. 9 S., R. 2 E., on stone	627.506
Red River, meander corner on, between sec. 24, T. 8 S., R. 2 E., and sec. 19, T. 8 S., R. 3 E., on stone	612.286

MONTAGUE QUADRANGLE (TEXAS-INDIAN TERRITORY).

Mr. R. Coe ran the railroad levels. Mr. J. P. Walker was attached to the subdivision and topographic party of Mr. A. D. Morton and Mr. R. Coe to that of Mr. J. Ahern's.

FROM RYAN, ALONG THE CHICAGO, ROCK ISLAND AND PACIFIC RAILWAY, TO TERRAL.

	Feet.
Ryan, 2¼ miles south of; a railroad spike in mile pole 513	840.443
Terral, at north end of siding; railroad spike in mile pole 519	844.706
Terral, 1 mile south of; a copper bolt in the west end of north pier of bridge 3219 over Red River	808.837

ALONG TOWNSHIP AND SECTION LINES.

Red River, meander corner on, between sec. 32, T. 6 S., R. 7 W., and sec. 5, T. 7 S., R. 7 W., iron post	814.696
Corner Ts. 6 and 7 S., Rs. 6 and 7 W., iron post	928.723
Corner Ts. 6 and 7 S., Rs. 5 and 6 W., iron post	854.532
Red River, meander corner on, between sec. 35, T. 6 S., R. 5 W., and sec. 2, T. 7 S., R. 5 W., iron post	763.381
Red River, meander corner on, between sec. 33, T. 6 S., R. 4 W., and sec. 4, T. 7 S., R. 4 W., iron post	749.0
Corner Ts. 6 and 7 S., Rs. 3 and 4 W., iron post	809.955
Red River, meander corner on, between sec. 31, T. 7 S., R. 3 W., and sec. 36, T. 7 S., R. 4 W., iron post	730.9
Red River, meander corner on, between sec. 35, T. 7 S., R. 6 W., and sec. 2, T. 8 S., R. 6 W., iron post	773.92
Corner Ts. 7 and 8 S., Rs. 6 and 7 W., iron post	887.629
Red River, meander corner on, between sec. 31, T. 7 S., R. 7 W., and sec. 6, T. 8 S., R. 7 W., iron post	800.916
Red River, meander corner on, between sec. 18, T. 8 S., R. 6 W., and sec. 13, T. 8 S., R. 7 W., iron post	793.836

ADDINGTON, RUSH SPRINGS, AND CHICKASHA QUADRANGLES.

The leveling was done by Mr. W. A. Lindsay, under the general direction of Mr. E. M. Douglas.

ALONG NINETY-EIGHTH MERIDIAN, BETWEEN RED AND CANADIAN RIVERS.

	Feet.
Initial point, concrete pier, marked "854"	854.445
Milepost No. 1, marked "913"	913.148
Milepost No. 2, marked "927"	926.937
Milepost No. 3, marked "863"	863.152
Milepost No. 4, marked "889"	900.306
Milepost No. 5, marked "933"	933.402
Milepost No. 6, marked "910"	910.077
Milepost No. 7, marked "868"	868.095
Milepost No. 8, marked "882"	881.942
Milepost No. 9, marked "868"	868.035
Milepost No. 10, marked "875"	874.803

	Feet.
Milepost No. 11, marked "883"	882.747
Milepost No. 12, marked "884"	883.811
Milepost No. 13, marked "895"	893.694
Milepost No. 14, marked "897"	897.435
Milepost No. 15, marked "931"	931.307
Milepost No. 16, marked "973"	973.565
Milepost No. 17, marked "979"	979.186
Milepost No. 18, marked "972"	971.815
Milepost No. 19, marked "939"	939.450
Milepost No. 20, marked "945"	945.447
Milepost No. 21, marked "1007"	1,007.407
Milepost No. 22, marked "1017"	1,017.701
Milepost No. 23, marked "1034"	1,034.313
Milepost No. 24, marked "1034"	1,033.938
Milepost No. 25, marked "1054"	1,054.209
Milepost No. 26, marked "1075"	1,075.657
Milepost No. 27, marked "1074"	1,074.173
Milepost No. 28, marked "1070"	1,070.598
Milepost No. 29, marked "1127"	1,127.602
Milepost No. 30, marked "1135"	1,135.599
Milepost No. 31, marked "1143"	1,143.029
Milepost No. 32, marked "1121"	1,121.527
Milepost No. 33, marked "1104"	1,103.753
Milepost No. 34, marked "1137"	1,137.530
Milepost No. 35, marked "1144"	1,144.152
Milepost No. 36, marked "1147"	1,147.096
Milepost No. 37, marked "1170"	1,169.849
Milepost No. 38, marked "1211"	1,211.093
Milepost No. 39, marked "1213"	1,212.849
Milepost No. 40, marked "1206"	1,206.236
Milepost No. 41, marked "1151"	1,151.06
Milepost No. 42, marked "1196"	1,195.923
Milepost No. 43, marked "1204"	1,203.528
Milepost No. 44, marked "1237"	1,236.832
Milepost No. 45, marked "1269"	1,269.383
Closing corner, Ts. 2 and 3 N., R. 8 W., marked "1244"	1,244.261
Milepost No. 46, marked "1243"	1,243.125
Milepost No. 47, marked "1235"	1,234.873
Milepost No. 48, marked "1241"	1,240.775
Milepost No. 49, marked "1260"	1,259.76
Milepost No. 50, marked "1297"	1,297.334
Milepost No. 51, marked "1279"	1,279.132
Milepost No. 52, marked "1357"	1,356.585
Closing corner, T. 3 N., R. 8 W., marked "1361"	1,360.641
Corner, Ts. 3 and 4 N., Rs. 7 and 8 W., marked "1362"	1,362.187
Milepost No. 53, marked "1365"	1,365.486
Milepost No. 54, marked "1356"	1,356.350
Milepost No. 55, marked "1335"	1,334.913
Milepost No. 56, marked "1308"	1,307.751
Milepost No. 57, marked "1256"	1,255.771
Milepost No. 58, marked "1328"	1,328.026
Standard corner, T. 5 N., Rs. 7 and 8 W., marked "1333"	1,332.686
Closing corner, T. 4 N., Rs. 7 and 8 W., marked "1307"	1,306.843

	Feet.
Milepost No. 59, marked "1267"	1,267.095
Milepost No. 60, marked "1232"	1,232.503
Milepost No. 61, marked "1127"	1,126.587
Milepost No. 62, marked "1114"	1,113.541
Milepost No. 63, marked "1185"	1,185.222
Milepost No. 64, marked "1174"	1,173.947
Corner, Ts. 5 and 6 N., Rs. 7 and 8 W., marked "1130"	1,130.09
Milepost No. 65, marked "1176"	1,175.871
Milepost No. 66, marked "1245"	1,245.524
Milepost No. 67, marked "1282"	1,281.734
Milepost No. 68, marked "1181"	1,181.33
Milepost No. 69, marked "1217"	1,216.582
Milepost No. 70, marked "1188"	1,188.36
Milepost No. 71, marked "1207"	1,207.293
Milepost No. 72, marked "1108"	1,107.991
Milepost No. 73, marked "1105"	1,104.619
Milepost No. 74, marked "1098"	1,098.02
Milepost No. 75, marked "1116"	1,115.786
Milepost No. 76, marked "1160"	1,159.796
Corner, Ts. 7 and 8 N., Rs. 7 and 8 W., marked "1158"	1,158.19
Milepost No. 77, marked "1197"	1,197.099
Milepost No. 78, marked "1185"	1,184.805
Milepost No. 79, marked "1177"	1,177.117
Milepost No. 80, marked "1210"	1,209.745
Milepost No. 81, marked "1259"	1,259.31
Milepost No. 82, marked "1290"	1,290.089
Closing corner, Ts. 8 and 9 N., R. 8 W., fractional, on second standard parallel north, marked "1293"	1,293.545
Standard corner, T. 9 N., Rs. 7 and 8 W., marked "1239"	1,239.036
Closing corner, T. 8 N., Rs. 7 and 8 W., marked "1234"	1,233.829
Milepost No. 83, marked "1293"	1,292.959
Milepost No. 84, marked "1294"	1,294.479
Milepost No. 85, marked "1307"	1,307.274
Milepost No. 86, marked "1357"	1,356.956
Milepost No. 87, marked "1411"	1,410.591
Milepost No. 88, marked "1327"	1,327.309
Corner, Ts. 9 and 10 N., Rs. 7 and 8 W., marked "1408"	1,408.496
Milepost No. 98, marked "1301"	1,300.578
Milepost No. 90, marked "1366"	1,366.462
Milepost No. 91, marked "1402"	1,402.437
Milepost No. 92, marked "1320"	1,320.216
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SOME PRINCIPLES AND METHODS

OF

ROCK ANALYSIS

BY

WILLIAM FRANCIS HILLEBRAND

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LETTER OF TRANSMITTAL.

DEPARTMENT OF THE INTERIOR,
UNITED STATES GEOLOGICAL SURVEY,
Washington, D. C., July 13, 1900.

SIR: I herewith submit, with a request for its publication as a bulletin of the United States Geological Survey, a manuscript dealing in very considerable detail with the subject of silicate rock analysis, with special regard to the practice in the Survey laboratory. It represents, in largely rewritten and much extended form, that portion of Bulletin 148 which dealt with the same subject. The present publication seems fully justified by the demand on the part of mineral chemists for Bulletin 148, the supply of which available for sale has been exhausted.

Very respectfully,

W. F. HILLEBRAND,
Chemist.

HON. CLARLES D. WALCOTT,
Director United States Geological Survey.

SOME PRINCIPLES AND METHODS OF ROCK ANALYSIS.

By W. F. HILLEBRAND.

PART I.—INTRODUCTION.

I. IMPORTANCE OF COMPLETE AND THOROUGH ANALYSES.

The composition of the ultimate ingredients of the earth's crust—the different mineral species which are there found and of many of which its rocks are made up—was the favorite theme of the great workers in chemistry of the earlier half of this century, and for the painstaking care and accuracy of Berzelius, Wöhler, and others, the mineralogists and geologists of to-day have need to be thankful. Considering the limited facilities at their disposal in the way of laboratory equipment and quality of reagents, the general excellence of their work is little short of marvelous. As an outgrowth of and closely associated with the analysis of minerals came that of the more or less complex mixtures of them—the rocks—to aid whose study by the petrographer and geologist a host of chemists have for many decades annually turned out hundreds of analyses of all grades of quality and completeness. With the growth and extraordinary development of the so-called organic chemistry inorganic chemistry gradually fell into a sort of disfavor. In many, even the best, European laboratories the course in mineral analysis, while maintained as a part of the curriculum of study, became but a subordinate prelude to the ever-expanding study of the carbon compounds, whose rapid multiplication, offering an easy and convenient field for original research and possible profit, proved a more tempting opening to young chemists than the often-worked-over and apparently exhausted inorganic pasture. For one student devoting his time to higher research on inorganic lines, fifty perhaps were engaged in erecting the present enormous structure of carbon chemistry. The instruction afforded the student in mineral analysis was confined to the ordinary separations of the commoner ingredients occurring in appreciable quantities, with little regard to supposed traces and with still less attempt to find out if the tabulated list really comprised all that the mineral or rock contained.

With the introduction of improved methods of examination by the petrographer, especially as applied to thin rock sections, and the use of heavy solutions, whereby, on the one hand, the qualitative mineral composition of a rock could be preliminarily ascertained with considerable certainty, and on the other, chemical examination of the more or less perfectly separated ingredients was rendered possible, a great help and incentive was afforded to the few chemists engaged in rock analysis. The microscope often obviated in part the necessity for tedious and time-wasting qualitative tests, and the heavy solutions, by permitting the concentration and separation of certain components, facilitated the detection of elements whose existence had long been overlooked.

Meanwhile, in the progress of chemistry new methods and reagents for qualitative detection and quantitative separation and estimation were gradually being discovered and devised. The supposed adequacy of some well-established methods was shown to be unwarranted; some had to be discarded altogether; others were still utilizable after modification. In the light thus shed it became possible to explain many hitherto incomprehensible variations in the composition of some rock species or types, as shown in earlier analyses, and in not a few cases it appeared that the failure to report the presence of one or more elements had obscured relations and differences which more thorough examination showed to exist (see pp. 16–17). Consequently there arose a feeling of distrust of much of the older work in the minds of those chemists and petrographers best fitted to judge of its probable qualities. This, and the incompleteness of nearly all the earlier work (and much of that of to-day, unfortunately), as shown by the largely increased list of those elements now known to enter into the normal composition of rocks, is rendering the old material less and less available to meet the increasing demands of the petrographer.

And yet these demands on his part are, with few exceptions, by no means so exacting as they should be. Often the analysis is intrusted to the hands of a student without other experience than that gained by the analysis of two or three artificial salts and as many comparatively simple natural minerals, and with a laboratory instructor as adviser whose experience in rock analysis may be little superior to his own. In other words, one of the most difficult tasks in practical analysis is expected to be solved by a tyro, and his results are complacently accepted and published broadcast without question. Even to those thoroughly familiar with the subject rock analysis is a complex and often trying problem. Although long practice may have enabled one to do certain parts of it almost mechanically, one is still from time to time confronted with perplexing questions which require trained judgment to properly meet and answer, and there is still room for important work in some of the supposedly simplest quantitative determinations. If the results are to have any decided value for purposes of scientific interpretation and comparison, they should be the product of one competent to find his way through the intricacies of an analysis in which from fifteen to twenty-five different components are to be separated and estimated with close approach to accuracy, and this a beginner can not hope to do in the majority of cases. The conscientious chemist should have a live interest in this matter. He should work with a two-fold purpose in view—that of lightening the labors of those who come after him by enabling them to use his work with less supplementary examination and of thereby enhancing his own reputation by meriting encomiums on work that has stood the test of time.

The petrographer, again, should seek to have his analyses made as complete as possible, and not, as is so often the case, be content with determinations of silica, alumina, the oxides of iron, lime, magnesia, the alkalies, and water. The latter, it is true, are entirely justifiable at times, and may serve the immediate purpose for which they were intended, but their incompleteness may, on the other hand, not only conceal points fruitful of suggestion to the attentive mind, but, what is of still greater importance, they may be actually misleading. Enough instances of totally inaccurate conclusions to be drawn from them have fallen under my own observation to fully justify this plea in favor of greater completeness in rock and mineral analyses made for purely scientific purposes.

The importance of the points indicated in the foregoing paragraph is shown by the difference between the analyses given on the following page. The specimens were taken and analyzed at widely separated times and by different persons, it is true, but they were unquestionably from the same rock mass, in which, however much the relative proportions of the different mineral constituents might vary within certain limits, there can be no reason to doubt the general distribution of all the elements shown by the second analysis.

	Earlier analysis.	Later analysis. [a]
SiO_2	54.42	53.70
TiO_2	....	1.92
Al_2O_3	13.37	11.16
Cr_2O_3	....	.04
Fe_2O_3	[b].61	3.10
FeO	[b]3.52	1.21
MnO	....	.04
CaO	4.38	3.46
SrO	....	.19
BaO	....	.62
MgO	6.37	6.44
K_2O	10.73	11.16
Na_2O	1.60	1.67
Li_2O	Trace.	Trace.
H_2O below 110° C	....	.80
H_2O above 110° C	[c]2.76	2.61
CO_2	1.82	....
P_2O_5	....	1.75
SO_3	....	.06
F	....	.44
Cl	....	.03
	99.58	100.40
Less O for F	....	.19
		100.21

[a] A still more recent analysis of another of the series of rocks of which this is an example has shown that this "later analysis" is itself probably incomplete and incorrect in part—incomplete because of the probable presence of 0.2 per cent or more of ZrO_2, incorrect because of the error in Al_2O_3 resulting from having counted the ZrO_2 as Al_2O_3, and from the fact that titanium is not fully precipitable in presence of zirconium by Gooch's method (the one employed). This latter error involves both the TiO_2 and the Al_2O_3. (See pp. 72-73.)

[b] From the fact that repeated determinations of the iron oxides in this and related rocks from the same region show always a great preponderance of ferric oxide, it is not improbable that the figures given for the two oxides in the first analysis were accidentally transposed.

[c] In the published analysis it does not appear whether this is total water or, as seems probable, only that remaining above 100° C.

Another instance of similar kind is given below. Here, again, certain differences are explainable by natural variations in the proportions of the constituent minerals, but it can hardly be doubted that TiO_2, BaO, SrO, P_2O_5, and SO_3 were present in both specimens in approximately the same amounts. In the earlier analysis determinations of some supposed unimportant constituents were purposely omitted, or made only qualitatively, with results that can not be otherwise than fatal to a full comprehension of the mineralogical nature of the rock.

	Earlier analysis.	Later analysis.
SiO_2	44.31	44.65
TiO_2	Not est.	.95
Al_2O_3	17.20	13.87
Fe_2O_3	4.64	6.06
FeO	3.73	2.94
MnO	.10	.17
CaO	10.40	9.57
SrO	....	[a] .37
BaO	....	.76
MgO	6.57	5.15
K_2O	3.64	4.49
Na_2O	4.45	5.67
Li_2O	....	Trace.
H_2O below 110° C	.77	.95
H_2O above 110° C	....	2.10
H_2O by ignition	3.30	....
CO_2	....	.11
P_2O_5	....	1.50
Cl	....	Trace.
SO_3	....	.61
	99.11	99.92

[a] Not entirely free from CaO.

Prof. F. W. Clarke has shown that the sum of titanic and phosphoric oxides in rocks of the earth's crust, averaged from hundreds of analyses, is 0.8 per cent. When the determination of these is neglected the error falls upon the alumina. If the latter is then used as a basis for calculating the feldspars, it is easy to see that a very large average error in the latter may result, amounting to several per cent of the rock.

In order to more strongly emphasize the importance of completeness in analysis, a few facts brought out by the hundreds of rock analyses made in this laboratory may be cited. It has been demonstrated most conclusively that barium and strontium are almost never-failing constituents of the igneous rocks of the United States and of many of their derivatives. These amounts are usually below 0.1 per cent for each of the oxides of those metals, but higher amounts are by no means uncommon. Furthermore, the weight of barium is almost without exception in excess of that of strontium. But a still more important point is that the igneous rocks of the Rocky Mountain region, so far as examined, show far higher average percentages of both metals than the rocks from the eastern and the more western portions of the United States. The following examples serve to illustrate certain types of Rocky Mountain igneous rocks: Of seven rocks forming a Colorado series, six held from 0.13 to 0.18 per cent of BaO, while in the seventh the percentage was 0.43. The SrO ranged from 0.07 to 0.13 per cent for six, and was 0.28 for that one highest in BaO. Of thirteen geologically related rocks from Montana, embracing basic as well as acid and intermediate types, the range of BaO was from 0.19 to 0.37 per cent, with an average of 0.30 per cent. Three others of the same series contained 0.10 per cent or less, while the seventeenth carried 0.76 per cent BaO. The SrO ranged from 0.37 per cent in the last instance to an average of 0.06 for the other sixteen. Certain peculiar rocks from Wyoming carry from 0.62 to 1.25 per cent BaO, and from 0.02 to 0.33 per cent SrO. Surely this concentration of certain chemical elements in certain geographic zones has a significance which future geologists will be able to interpret, if those of to-day are not.

Again, vanadium is an element which few chemists have ever thought of looking for in igneous rocks, though it has long been known to occur in magnetites and other iron ores. Hayes, in 1875, reported its occurrence in a great variety of rocks and ores. Quoting from Thorpe's Dictionary of Chemistry: "It is said to be diffused with titanium through all primitive granite rocks (Dieulafait), and has been found by Deville in bauxite, rutile, and many other minerals, and by Bechi and others in the ashes of plants and in argillaceous limestones, schists, and sands." It is further reported to comprise, as the pentoxide, up to 0.1 per cent of many French and Australian clays, 0.02–0.03 per cent of some basalts, 0.24 per cent of a coal of unknown origin, and 0.45 per cent of one from Peru. Still later examinations in this laboratory of about 100 rocks, chiefly igneous, covering the whole territory of the United States, show not only its general qualitative and quantitative distribution, but that it predominates in the less siliceous igneous rocks and is absent, or nearly so, in those high in silica. In some of the more basic rocks it occurs in sufficient amount to seriously affect the figures for the oxides of iron unless separately estimated and allowed for (see p. 96)—a matter of considerable importance, since the petrographer lays great stress on accuracy in their determinations.

This same investigation has also thrown some light on the distribution of molybdenum, which seems to be confined to the more siliceous rocks and to occur in quantities far below those commonly found for vanadium.

Finally, had it not been the writer's practice of late years to look for sulphur in rocks, even when no sulphides were visible to the eye, its almost invariable presence in the form of sulphide, and consequent connection with the long mystifying lack of agreement between results for ferrous iron obtained by the Mitscherlich and the hydrofluoric-acid methods, might not have been suspected. (See p. 89.)

While strongly upholding the necessity for more thorough work, necessarily somewhat at the expense of quantity, it is far from the writer's intention to demand that an amount of time altogether disproportionate to the immediate objects to be sought should be expended on every analysis. But it is maintained that in general the constituents which are likely to be present in sufficient amount to admit of determination in the weight of sample usually taken for analysis—say 1 gram for SiO_2, Al_2O_3, etc., to 2 grams for certain other constituents—should be sought for, qualitatively at least, in the ordinary course of quantitative work, and their presence or absence noted among the results. If present in little more than traces, that knowledge alone may suffice, for it is often more important to know whether or not an element is present than to be able to say that it is there in amount of exactly 0.02 or 0.06 per cent. In the tabulation of analyses a special note should be made in case of intentional or accidental neglect to look for substances which it is known are likely to be present. Failure to do this may subject the analyst to unfavorable criticism, when at some future time his work is reviewed and the omissions are discovered by new analyses.

Finally, whenever possible, a thorough microscopical examination of the rock in thin section should precede the chemical analysis. This may be of the greatest aid to the chemist in indicating the presence of unusual constituents, or of more than customary amounts of certain constituents, whereby, possibly, necessary modifications in the analytical procedure may be employed without waste of time or labor.[1]

II. OBJECT AND SCOPE OF THE PRESENT TREATISE.

The literature relating to analysis of silicates is extensive but scattered, and in no single article is there to be found a satisfactory exposition of the methods to be followed or the precautions to be observed, especially in the search for some of the rarer constituents or those which, without being rare, have been of late years recognized as occuring persistently in small amounts. It is not intended to make this little volume a treatise on mineral analysis, but it is believed that the experience gained by the chemists of this Survey during the twenty years since the establishment of its first chemical laboratory in Denver may be useful to most chemists interested in mineral and especially rock analysis.

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[1] The foregoing tables and accompanying remarks, including several sentences preceding the tables, have been largely taken from the writer's papers entitled "A plea for greater completeness in chemical rock analysis," published in the Journal of the American Chemical Society, Vol. XVI, pp. 90–93, 1894; also in the Chemical News, Vol. LXIX, p. 163, 1894. See also "Distribution and quantitative occurrence of vanadium and molybdenum in rocks of the United States," in the American Journal of Science, 4th series, Vol. VI, p. 209, 1898, and Chemical News, Vol. LXXVIII, p. 216, 1898.

The original publication of these data in Bulletin No. 148 was primarily intended to show the principles and methods according to which the major part of the very many hundreds of analyses therein brought together had been executed, and thus to furnish a partial measure of the trustworthiness of those analyses, rather than to serve as a practical manual of rock analysis. But the use which has been made by mineral chemists of that bulletin has seemed to render it advisable to amplify somewhat in detail and to add, besides a few new methods, a number of alternative ones which are known or believed to be good, in order that those who may wish to use this treatise as a practical guide shall have a choice from which to select in case the rather expensive apparatus or complicated arrangements sometimes preferred are not available. Where silicate analyses are very frequently made, however, it is a saving of time and of money in the end to set up permanent arrangements for convenience in estimating water, carbon dioxide, ferrous iron, making reductions in hydrogen, etc.

Stress will be laid on those points meriting particular attention, and now and then a brief discussion or criticism of methods elsewhere in vogue may be entered into.

In the earlier years of the existence of the Washington laboratory opportunity was afforded for the testing of novel methods and the devising of new ones, with most excellent results, as shown especially by the methods for separation of titanium, of lithium, and of boron, due to Prof. F. A. Gooch, to whose inventive skill chemists owe likewise the perforated filtering crucible and the tubulated platinum crucible arrangement for the estimation of water. Of late years the press of routine work has been such as to more fully fill up the time of the much-reduced chemical force, and as a consequence it has been found impossible to subject to critical trial several separation methods of recent origin, some of which seem to be full of promise, or to follow out certain lines of investigation which have been suggested by the observations made in this laboratory. This, then, must be offered in explanation if, in the following discussion, it may seem to some that any of the methods followed are too conservative. In general the discussion will be confined strictly to such separations as may be required in the analysis of an igneous, metamorphic, or sedimentary silicate rock of complex mineralogical composition, in which the majority and possibly all of the ingredients in the list given below may occur in weighable or readily discoverable quantities:

SiO_2, TiO_2, ZrO_2, Al_2O_3, Fe_2O_3, Cr_2O_3, V_2O_3, FeO, MnO, NiO, CoO, MgO, CaO, SrO, BaO, ZnO, CuO, K_2O, Na_2O, Li_2O, H_2O, P_2O_5, S,[1] SO_3 C,[2] CO_2, Fl, Cl, N.

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[1] Usually as pyrite, occasionally as lazurite, not infrequently as pyrrhotite.

[2] As graphite or coaly matter.

The special problems often arising in the analysis of rocks of extraterrestrial origin—the more or less stony meteorites—will not be considered. An analysis of that kind should never be intrusted to the novice, but only to the chemist who has a knowledge of the composition and properties of the peculiar mineral constituents of those bodies and a judgment fit to cope with the oftentimes difficult problems presented by them.

Thorium, cerium, and other rare earths are seldom encountered in quantities sufficient to warrant the expenditure of the time necessary for their isolation. A search for them qualitatively, even, is at present rarely justifiable unless there is microscopic or other evidence of the presence of minerals likely to contain them. Tantalum, columbium, boron, and glucinum have never been certainly met with in the writer's experience, and yet they must be present in certain rocks, and doubtless traces have been overlooked at times. There is no reason to suppose that other elements may not be found by careful search, possibly all in the known category, and, indeed, Sandberger's researches have shown to what an extent this is true of a large number of those elements contributing to the filling of metalliferous veins. But those in the above list may usually be estimated with ease in weights of from one-half to 2 grams.

If the point be raised that many of the published analyses emanating from the Survey laboratories, even the earlier ones of the writer, are not in accord with the advocacy of completeness contained in the foregoing pages, it may be remarked that these ideas have been to a considerable degree evolved during a personal experience of twenty years in this line of work, and that frequently the exigencies were such as to compel restriction in the examination. Where the latter has been the case subsequent developments have in some cases shown it to be bad policy in every respect. It is better, both for the geologist and the chemist, to turn out a limited amount of thorough work than a great deal of what may prove to be of more than doubtful utility in the end.

III. STATEMENT OF ANALYSES.

Until recently it has been the practice in this laboratory to tabulate the constituents of a rock somewhat in the order of their determination, beginning with SiO_2 as the chief constituent and grouping together all chemically related oxides, as shown, for instance, on pages 16 and 17.

From a strictly scientific point of view a chemical classification founded on a separation into basic and acidic atoms or radicals would be more satisfactory, but until we learn to find out what silicic radicals are present and in what relative amounts, also how much free silica there may be, it is useless to think of employing the arrangement so valuable in stating water analyses.

Of late petrographers have begun to demand, with considerable reason, an arrangement "which shall bring the essential chemical features—both the percentage figures and the molecular ratios—prominently and compactly before the eye, so that the general chemical character and the relations of the various constituents may be seen at a glance."[1]

In accordance with this demand it is now our practice to follow pretty closely the arrangement proposed by Pirsson and very recently strongly advocated by Washington (loc. cit.), namely:

SiO_2, Al_2O_3, Fe_2O_3, FeO, MgO, CaO, Na_2O, K_2O, H_2O (above 105-110° C.), H_2O (below 105-110° C.), CO_2, TiO_2, ZrO_2, P_2O_5, SO_3, Cl, Fl, S (FeS_2), Cr_2O_3, V_2O_3, NiO, CoO, CuO, MnO, SrO, BaO, Li_2O, C, NH_3.

By this arrangement the nine constituents which in the great majority of cases determine the character of the rock are placed at the head of the list, thus greatly facilitating the comparison of different analyses similarly arranged, especially when, as Washington recommends, the molecular ratios are calculated for these leading constituents and placed immediately after the corresponding oxides. The order of the remaining members is determined somewhat by the following considerations: CO_2 is placed next after H_2O, since these two are generally a measure of the alteration the rock may have undergone. TiO_2 and ZrO_2 naturally follow CO_2 on chemical grounds, and SO_3 and Cl, being common constituents of the sodalite group, are conveniently placed together.

IV. TIME NEEDED FOR MAKING AN ANALYSIS.

The question has often been put, "How long does it take to complete an analysis of this kind?" This will depend, of course, on the mineral complexity of the sample and on the personal factor of the individual worker. If there is a competent assistant to do the grinding, and specific-gravity determinations are not required, it is quite possible after long experience for a quick worker to learn to so economize every moment of time in a working day of seven hours, with an abundance of platinum utensils and continuous use of air and water baths through the night, as to finish every three days, after the completion of the first analysis, barring accidents and delays, one of a series of rocks of generally similar character, each containing from eighteen to twenty quantitatively determinable constituents, excluding, for instance, fluorine, carbon as such, nitrogen, metals of the hydrogen sulphide group, and cobalt. On one occasion a series of fourteen rocks, of comparatively simple composition, was completed in one month, with the help of an assistant who made the phosphorus and ferrous iron determinations. But such an output of work is more than exceptional and implies an unusual freedom from those occasional setbacks to which every chemist is exposed.

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[1] H. S. Washington, The statement of rock analyses. Am. Jour. Sci., 4th series, Vol X, p 61, 1900

It should here be remarked that the Survey laboratory is most exceptionally well supplied with all kinds of platinum vessels and utensils, so that it is rare indeed for delay to arise through lack of dishes of even the largest sizes.

V. TWO USEFUL AIDS IN CHEMICAL MANIPULATION.

In connection with the foregoing remarks it is in place to mention two aids to the chemist which are in constant use in this laboratory and have come to be well-nigh indispensable. Neither is novel in principle and both are in use elsewhere, but they are not so commonly known as they deserve to be, hence this allusion to them.

Fig. 1 represents a form of platinum-tipped crucible tongs devised by Dr. A. A. Blair many years ago. With them a crucible can be securely grasped and brought into any desired position while still hot. To the contents, if in fusion over the blast flame, can be imparted the rotatory motion so often desirable. Above all, the cover need not be in the slightest degree displaced, as when using the common form of platinum-tipped tongs.

Fig. 2 represents a very useful adjunct to the worktable and especially to the draught cupboard, whereby the liquid contents of crucibles can be speedily evaporated at almost any desired temperature and the dehydration of many solids effected much more safely than on an iron plate or sand bath. I do not recall who originated this form of air bath, but it has been in use here for over fifteen years and is identical in principle with the Nickelbecher of Jannasch. Nickel undoubtedly has a certain advantage in not rusting as does iron, but the form depicted in R of fig. 2 can easily be made anywhere of sheet iron riveted at the joint, the bottom (not shown in the figure) being securely held by a flange at the extremity of the truncated cone. A crucible placed on the platinum triangle becomes uniformly heated by hot air, and large quantities of liquid, even sulphuric acid, can be thus volatilized in a short time without ebullition or spattering.

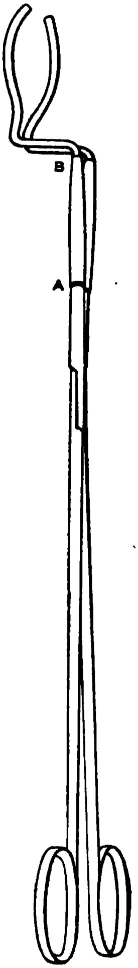

FIG. 1.—Platinum-tipped crucible tongs. The parts A B, also of heavy platinum, are hollow to serve as sockets for the cheaper metal of the handles.

VI. LIMITS OF ALLOWABLE ERROR IN SUMMATION OF ANALYTICAL RESULTS.

As is well known, a complete silicate rock analysis which foots up less than 100 per cent is generally less satisfactory than one which shows a summation somewhat in excess of 100. This is due to several causes. Nearly all reagents, however carefully purified, still contain or extract from the vessels used, traces of impurities, which are eventually weighed in part with the constituents of the rock. The dust entering an analysis from first to last is very considerable, washings of precipitates may be incomplete, and if large filters are used for small precipitates the former may easily be insufficiently washed.

Given the purest obtainable reagents, an ample supply of platinum, facilities for working, and a reasonably clean laboratory, there is no excuse for failure on the part of a competent chemist to reach a summation within the limits 99.75 and 100.50. Failure to attain 100 per cent in several of a series of analyses of similar nature should be the strongest evidence that something has been overlooked. Excess above 100.5 per cent should be good ground for repeating portions of the analysis in order to ascertain where the error lies, for it is not proper to assume that the excess is distributed over all determined constit-

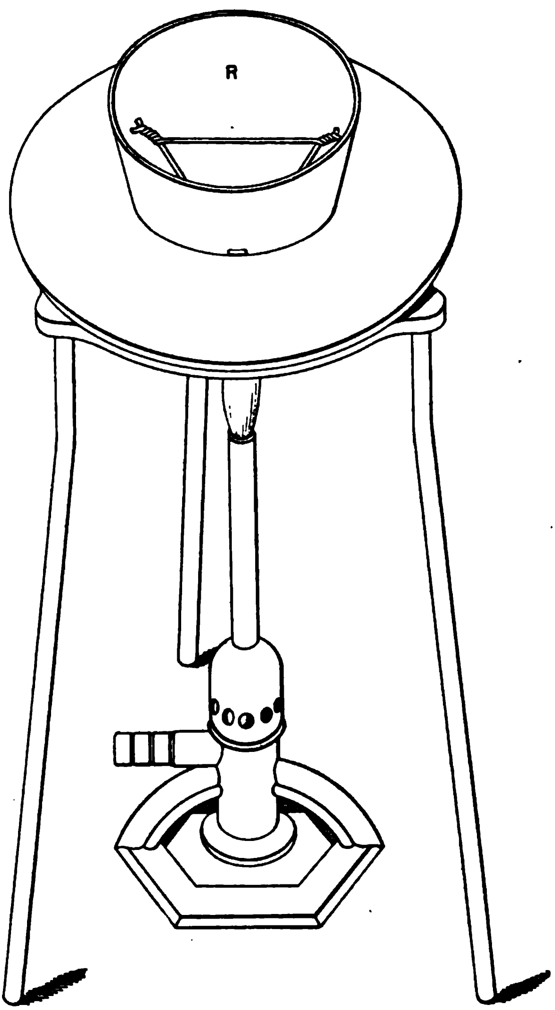

FIG. 2.—Radiator for rapid and safe evaporation. R is of sheet iron, also nickel (Jannasch). Various sizes. A convenient height is 7cm, width at top 7cm and at bottom 5cm.

uents. It is quite as likely, in fact more than likely, to affect a single determination and one which may be of importance in a critical study of the rock from the petrographic side.

VII. QUALITY OF REAGENTS.

All analyses performed in the Survey laboratories have been made with the purest reagents obtainable, either by purchase in the open market or by special preparation on the part of manufacturers or in the laboratory. The best acids made in this country are of a high grade and need no redistillation except for special experiments. Ammonia has always been redistilled at short intervals; and no sodium carbonate which exceeds 2½ milligrams of total impurity (see p. 50) in 20 grams (0.012 per cent) is used for the main portions, in which silica, alumina, etc., are to be estimated. For other portions, as phosphoric acid, fluorine, sulphur, a poorer grade is entirely allowable, provided it is free from the element to be determined, and from any other which might interfere with its estimation.

Hydrofluoric acid was always freshly distilled with potassium permanganate until the introduction of ceresine bottles afforded an article sufficiently pure for all but the most exacting work. Care must be exercised even yet, however, that no particles of paraffin or ceresine are floating on the acid, and that the latter is free from traces of chlorine whenever it is to be used for attacking silicates with a view to estimating chlorine (p. 103).

Potassium bisulphate has usually been prepared in the laboratory from sulphuric acid and potassium sulphate, since it is not always to be bought of satisfactory quality. Even then the normal sulphate had first to be examined, for it has been found to contain, on different occasions, notable amounts of lead, calcium, and silica.

The phosphorus salt used for precipitating magnesium has been found to contain iron and silica, and calcium is almost always a constituent of ammonium oxalate. The latter has therefore to be purified or specially prepared, as also oxalic acid, ammonium chloride (in which latter manganese has been observed), and occasionally other reagents. Some hydrogen peroxide contains fluorine, which renders it unfit for use as a chemical reagent.

A "C. P." label is no guaranty whatever of the purity of a reagent; hence no chemicals should be taken on trust because of bearing such a label. Every new purchase should be examined, if it is one in which purity is a desideratum. In general all so-called "C. P." chemicals should at least stand the tests laid down by Krauch.[1]

Of late years the appearance upon the market of so-called guaranteed reagents promised to meet a long-felt want. But experience has shown that with the pioneer in this line at least the guaranty amounts to nothing, the reagents being sometimes worse than the "C. P." articles emanating from sources which make no claim to special purity for their goods, and redress being unobtainable. The "guaranteed reagent" needs checking as much as any other.

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[1] Die Prufung der chemischen Reagentien, 3d ed., Berlin, Julius Springer, 1896.

VIII. PRELIMINARY QUALITATIVE ANALYSIS.

A complete qualitative analysis of a rock, preceding the quantitative examination, is in most cases a sheer waste of time. A few constituents may now and then be specially looked for, but in general time is saved by assuming the presence of most of them and proceeding on that assumption in the quantitative analysis.

PART II. METHODS.

I. INTRODUCTORY REMARKS.

The order hereinafter followed in describing the various chemical separations has little relation to the affinities of the constituents of the rock, but those are grouped together which can be conveniently determined in the same portion of rock powder. Thus, in the main portion are usually determined SiO_2, TiO_2, MnO, NiO, CaO, SrO, MgO, total iron, and the combined weight of all the following: Al_2O_3, TiO_2, P_2O_5, ZrO_2, all iron as Fe_2O_3, and nearly if not quite all vanadium as V_2O_5, also perhaps rare earths if present. In a separate portion is estimated FeO, and also the total iron, as well as BaO, if these last are desired as checks. The alkalies need a portion for themselves. In another, ZrO_2, BaO, and total sulphur are very conveniently determined. For V_2O_3 and Cr_2O_3 still another and usually much larger portion is to be used. Determinations of CO_2, C, H_2O, Fl, Cl, are all best made in separate portions of substance, though various combinations are possible, as CO_2 and H_2O, C and H_2O, or H_2O, Fl, and Cl. In fact, by a judicious selection and combination of methods a very satisfactory analysis can sometimes be made on 4 grams of material without omission of anything of importance, though the time consumed will be greater than if ample material is available.

As an illustration of the advantage to be gained by a little judgment in the combination of methods, the case of sulphur, barium, and zirconium may serve. Many chemists never look for the second and third of these, but by following the procedure given on pages 74–76 very little more labor is expended in confirming their presence or absence than that of sulphur alone.

With only occasional exceptions, nearly all the constituents mentioned on page 20 can be estimated if present in portions of powder not exceeding 1 gram each in weight.

This is a convenient weight to take for the main portion in which silica, alumina, etc., the alkaline earths, and magnesia are to be sought; but it should, in general, be a maximum, because if larger the precipitate of alumina, etc., is apt to be unwieldly. Its weight can not often be much reduced with safety if satisfactory determinations of manganese, nickel, and strontium are to be expected. For the alkali portion one-half gram is a very convenient weight. In general, it may be made a rule not to use more than 2 grams for any portion which has to be fused with an alkali carbonate, as for sulphur, fluorine, and chlorine. For carbon dioxide the weight may rise to 5 grams, or even more, if the amount of this constituent is very small, without expenditure of any more time than is required by 1 gram, and with correspondingly greater approach to correctness in the result. For vanadium also a larger weight than 2 grams is usually demanded.

II. SPECIFIC GRAVITY.

BY SUSPENSION IN WATER.

Ordinary method.—This determination, when required, is best made upon one or several fragments weighing up to 20 grams. They are held together by a fine platinum wire ready for suspension from the balance, and thus held are placed in a small beaker to soak over night in distilled water under the exhausted receiver of an air pump, side by side with a similar beaker of water. Boiling is, of course, a much less effective means of removing air than the air pump, and the boiling water may exert an undesirable solvent and abrading effect. In the morning the wire is attached to the balance arm, the rock fragments remaining immersed in the water; a thermometer is placed in the companion beaker of water, now likewise in the balance case, and the weight is at once taken. Both vessels of water having precisely the same temperature, it is quite unnecessary to wait for the water to assume that of the balance should it not already possess it. The fragments are now lifted out, without touching the vessel, and carefully transferred to a tared crucible or dish; the wire is removed and at once reweighed, with the precaution that it dips just as far into the water now as when weighted. Hereby a special weighing of the wire out of water is avoided. The sample may now be dried on the water bath and then at 110° C. for some hours to certainly expel all absorbed water, and weighed after prolonged cooling in the desiccator. It is better to ascertain the weight of the dry rock after soaking in water than before, in order to avoid the error due to possible breaking off of a few grains between the two weighings. Should the density of the rock in air-dry condition be required, it may be left exposed to the air for a long period after drying and before weighing;[1] but the difference will only in exceptional cases affect the second decimal by more than a single unit. For instance, an undried rock of 2.775 specific gravity containing in the uncrushed state the high percentage of 0.3 hygroscopic moisture will have a density of 2.79 when dry; a rock of 2.982 specific gravity, undried, will have a density of 3.00 after removal of 0.3 per cent of moisture. The difference becomes greater as the density of the rock increases.

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[1] In view of the uncertainty as to what constitutes hygroscopic water (see p. 35), this course is perhaps more to be commended than the former, and seems imperative for certain zeolitic rocks. In such cases it is best to weigh the fragments before putting to soak, and afterwards to collect on a Gooch crucible the grains which may have fallen off in the water. Should no crucible of this kind be available, a paper filter may unhesitatingly be used and incinerated with the powder, owing to the small amount of which the error due to loss of even all its water during ignition is quite negligible.

This method of ascertaining the specific gravity of rocks is certainly more convenient than, and for compact rocks is believed to be decidedly preferable to, that of the pycnometer, in which the fragments must be reduced to small size with consequent formation of more or less powder, which is subject to slight loss in the various manipulations. To exclude this powder and employ only small fragments would introduce a possible source of error, since it is likely to consist largely of the most easily abraded minerals and consequently not to have the average composition of the mass. By following the instructions given above, loss of material is absolutely avoided, a decided saving in time is effected, and considerable weights can be easily employed with consequent lower probable error in the results. To vesicular rocks, however, notably certain lavas, the above procedure is, of course, inapplicable, unless the datum is desired for certain considerations in which the relative density of large rock masses as they occur in nature is sought, as for the comparison of building stones or the calculation of large known or assumed areas of particular rocks.

Penfield's method for mineral fragments.—Penfield[1] recommends the following modification of the suspension method as more convenient than that by the pycnometer in many cases for small fragments of minerals.

After boiling in water, the substance is transferred with water to a small glass tube about 8 mm. by 35 mm., provided with a fine platinum wire for suspension. This is weighed full of water in another vessel of water, and again after the removal of the mineral, the weight of which is found after drying.

This method is, of course, more applicable to homogeneous minerals than to rock fragments, and will therefore be applied in rock analysis chiefly to the determination of the specific gravity of the mineral grains separated by heavy solutions or acids.

PYCNOMETER METHOD.

If the pycnometer has to be used, as is generally the case when the density of any one of the mineral ingredients of a rock is desired after separation by one of the approved methods, it being then in a more or less finely divided state, the most accurate procedure is that adopted in this laboratory by Mr. L. G. Eakins a number of years ago. The pycnometer used is one with a capillary stopper, provided with a millimeter scale etched in the glass, the divisions being numbered both ways from the center and calibrated by mercury, so that the value of each one in weight of water is known. The capacity of the flask filled with water to the zero division is then calculated for every half degree of temperature from 0° C. to 30° C., by making a series of careful weighings, in which, the capacity of the stem being known, it is quite immaterial at what level the water stands provided it is within the limits of the scale. The exact temperature is obtained by an accurate thermometer placed in a companion vessel of similar shape to the pycnometer and containing a like amount of water, both being left in the balance case till its temperature has been nearly or quite assumed, as shown by a second thermometer. The weighing must of course be made before the thread of water has sunk beneath the lowest division, which it will do after a time, even though at first filling the bore to the top of the stopper; and the corrected weight full of water to the zero mark is found by adding or subtracting the needed amount, as shown by the height of the thread on the scale.

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[1] Am. Jour. Sci., 3d series, Vol. L, p. 448, 1895.

For each pycnometer in use, and these are of different sizes, is prepared a table showing its weight, the value of each scale division in grams of water, and the capacity of the flask at different temperatures, as indicated above. The preparation of such a series of flasks is time saved in the end, for the weighing of the flask full of water each time a density determination is made is rendered superfluous. All that is necessary is to look up in the table the weight corresponding to the temperature.

The density of the previously weighed substance in this case is now determined in much the same way, after the unstoppered pycnometer containing it and nearly filled with water has stood with its companion vessel of water under the air pump the necessary length of time. The water needed to fill the flask is taken from its companion.

All who have used the pycnometer method for fine substances know the difficulty experienced in preventing a portion from being held at the surface, despite all attempts at making it sink. Hence it often happens that a very small portion runs out around the sides of the stopper on inserting it. If the flask rests in a small tared dish the grains thus forced out may be washed down into it and weighed after evaporation in order to get the correct weight of that in the flask; or, after weighing, the contents of the flask may be emptied into a tared dish and the water slowly evaporated off in order to get the weight of the mineral. Usually this way is less to be recommended than the other.

HEAVY SOLUTIONS NOT SUITABLE FOR ROCKS.

Because of their roughness, porosity, and complex mineral composition the density of rock fragments can not be accurately determined by that of heavy solutions in which they may remain suspended.

III. PREPARATION OF SAMPLE FOR ANALYSIS.

QUANTITY OF ROCK TO BE CRUSHED.

In the great majority of cases a few chips from a hand specimen will well represent the average of the mass, but with rocks in which a porphyritic structure is strongly developed the case is different. Here a large sample should be provided, gauged according to the size of the crystals, and the whole of this should be crushed and quartered down for the final sample. Unless this is done, it is manifest that the analysis may represent anything but the true average composition of the rock.

CRUSHING.

Mechanical appliances for reducing samples to fine powder are much in use in technical laboratories, where they answer their purpose more or less satisfactorily, and something similar is needed in those scientific laboratories where rock analysis is of daily occurrence and many samples must be reduced to fine powder in a short space of time. For accurate analyses the use of steel crushers and mortars is out of the question, because of the danger of contamination by particles of metal and the impossibility of cleansing the roughened surfaces after they have been in use a short time. Extraction by the aid of a magnet of steel particles thus introduced into the powder is quite inadmissible, since the rocks themselves, almost without exception, contain magnetic minerals. The method of rough crushing on a small scale found to be most satisfactory in practice is to place each fragment as received on a hard steel plate about 4½ cm. thick and 10 cm. square, on which is likewise placed a steel ring 2 cm. high and of about 6 cm. inner diameter, to prevent undue flying of fragments when broken by a hardened hammer. In this way a considerable sample can soon be sufficiently reduced for transfer to the agate grinding mortar with a minimum of metallic contamination.

For breaking large pieces of rock to small sizes a thick iron plate with specially hardened surface and a similarly hardened pounder, such as street pavers use, will probably render the best service, but the hardening must be done with extreme care.

GRINDING.

Of the various grinding arrangements on the market purporting to fulfill their purpose few, if any, observed have met the conditions required by the work in hand. Either the mechanical arrangement is complicated or cumbersome, requiring more power or space than is usually at disposal or causing too much noise, or thorough cleansing is difficult and troublesome, or there is likelihood of contamination from oil or grease or lack of facility for the removal of all powder from the mortar. These last defects are especially prominent in those forms in which the mortar is fixed in its setting.

All rock samples have therefore been reduced to powder by hand, involving a great expenditure of time and labor. Ordinarily an extremely fine state of division is unnecessary, except in the case of those portions in which alkalies and ferrous iron are to be estimated or where soluble constituents are to be removed by acids, etc., and in such cases the final grinding can be done at the balance table on a small portion slightly in excess of the quantity to be weighed off.

The process of sifting through fine cloth, the German "Beuteln," is not one always to be commended, because of the time required and, more especially, because of the certainty of contamination by cloth fiber, which in the ferrous-iron portion might affect the result. Still less should metal sieves be used.

WEIGHT OF GROUND SAMPLE.

The sample when ground should weigh not less than 10 grams, and preferably 20 in case it should be necessary to repeat or advisable to employ unusually large portions for certain determinations, notably carbonic acid. Rock analysis has in this respect an advantage over mineral analysis, since material is almost always available in ample quantity and any desired number of separate portions may be used, whereas with a mineral the analyst is frequently compelled to determine many or all constituents in a single, often very small, portion of the powder. This course often involves delay and the employment of more complicated methods of separation than are usually necessary in rock analysis.

IV. WATER—HYGROSCOPIC, ZEOLITIC, CRYSTAL.

Importance of employing air-dry powder for analysis.—The time-honored custom of drying a powdered specimen before bottling and weighing has long seemed to the writer one that has no sound basis in reason. Its object is of course plain, namely, that of securing a uniform hygroscopic condition as a basis for convenient comparison of analytical results, since some rocks contain more hygroscopic moisture than others. Nothing, however, is more certain than that by the time the substance is weighed it has reabsorbed a certain amount of moisture, small, indeed, in most cases, but very appreciable in others; and further, with every opening of the tube moisture-laden air enters and is inclosed with the remainder of the dry powder. It therefore may very well happen that a powder at first dry will, after several openings of the tube, especially at considerable intervals, be nearly as moist as when first inclosed.

It is preferable to weigh the air-dry powder and to make a special determination of moisture. If all the portions necessary for an analysis are weighed out one after another, or even at different times on the same day, the error due to difference of hygroscopicity in dry and moist weather, which for most of the separate portions is an entirely negligible quantity, is eliminated. Only in the main portion, in which silica and the majority of the bases are to be estimated, can it ever be an appreciable factor.

Temperature of drying.—As to the temperature to be adopted for drying in order to determine so-called hygroscopic moisture, the practice has varied at different times and with different workers, ranging from 100° to 110° C. For the great majority of rock specimens it is quite immaterial which of these temperatures is adopted, since no greater loss is experienced at the higher than at the lower temperature, given a sufficient time for the latter. It is the present practice in this laboratory to employ a toluene bath giving a temperature of about 105° C. Should the results show a very unusually high loss, the powder is reheated at, say, 125°, in order to learn if the loss is progressive with increased temperature. In the affirmative case it may be well to repeat the drying at 100°, for a portion of the loss at 105° was probably due to combined water from a mineral or minerals in the rock; but in that case even the loss at 100° may sometimes very well include combined water, in which case drying over sulphuric acid alone may be desirable, or over dry sand.

Cautionary hints.—In this latter connection it is proper to point out certain pitfalls in the path of the unwary, which, however, are far more likely to be encountered in the analysis of minerals, where their influence may be of far-reaching consequence.

A mineral which loses a great deal of water over sulphuric acid—2 or 3 per cent, for instance—may need an exposure of several days or even weeks for its complete extraction. If the weighings are made from day to day, the apparent limit may be reached long before all water really removable has been taken up by the acid. Whenever the crucible, after weighing, is replaced in the desiccator it is no longer in a dry but a more or less moist atmosphere, and its contents, even when covered, sometimes absorb a part of this moisture and retain it so persistently that the acid is unable to bring the powder beyond its previous state of dryness in the next twenty-four hours. In fact, it may be unable even to reach it unless greater time is allowed. An experiment on 1 gram of tyrolite, made and published some years ago, seems to illustrate this point in part:

Hours exposed.	Loss.	Hours exposed.	Loss.
	Gram.		*Gram.*
18	0.0231	24	0.0002
26	.0083	24	.0003
23	.0029	48	.0006
24	.0012	24	.0002
23	.0008	283	.0380
24	.0001		
25	.0003		

The experiment might reasonably have been considered ended after the one hundred and fifty-eighth hour, when a loss of but 0.1 milligram was shown during twenty-four hours; but nevertheless a nearly steady loss of 0.3 milligram per day took place for six days more, and might have been longer observed but for the interruption of the experiment.

Again, it is a common practice to determine the water given off by hydrous minerals in an air bath at temperatures far above 100° C. To insure accuracy this experiment should not be made in crucibles or dishes which must be cooled in a desiccator. One instance will suffice: A gram of a mineral mixture containing about 17 per cent of water, of which about 3 per cent was driven off at 100° and 8 or 9 per cent at 280°, was, after several hours' heating at the latter temperature, placed in a desiccator over sulphuric acid and weighed as soon as cold, then replaced and again weighed the next day. It had regained 1½ per cent of its original weight, although the desiccator was tightly closed and the crucible covered, showing apparently a drying power superior to that of the acid.

A specimen of tyrolite was found on one occasion to lose 10.34 per cent at 280° C., and on another occasion 14.33 per cent. In the latter case the drying and heating at progressive temperatures had continued during a period of 528 hours, the weighings being made usually from day to day; whereas in the former the duration of the experiment was much shorter and the intervals between weighings were but a few hours each.

Procedure in special cases.—For experiments of the kind just indicated the powder should be heated in a weighed tube, through which a current of dry air can be passed, and allowed to cool therein, or else the water given off should be collected and directly weighed in suitable absorption tubes, even though the long time often required is an objection to this latter method, since the absorption tube may gain weight, other than that of the water from the mineral, sufficient to introduce an appreciable error.

The recent important research of Friedel[1] well shows what errors are possible in the determination of this easily removable water, since he found that certain zeolites which had been largely dehydrated but not heated to the point of rupture of the molecular net, could then absorb, instead of water, various dry gases in which they might be placed, as carbon dioxide, ammonia, carbon disulphide, and others, even air in large quantities, and certain liquids. In the light of this observation the cause of the great increase of 1½ per cent in weight of the partially dehydrated mineral mentioned on p. 34 may very possibly be attributed to air from the desiccator instead of moisture, as was at the time supposed. At any rate, as Friedel says, the danger of accepting a loss in weight as an index of the amount of water lost is clearly shown, and thus that method of determining water is for many cases fully discredited. Just what method to adopt must be largely left to the judgment of the operator, who will often be guided by the mineral composition of the rock as revealed by the unaided eye or the microscope.

Friedel (loc. cit.) indicates a means for determining the true weight of water lost by minerals behaving like the zeolites, even without collecting the water lost, namely, by driving out of the dehydrated and weighed mineral, under proper precautions, any air it may have absorbed in the process of drying and cooling, and collecting and measuring this air, and thus finding its weight, which, added to the apparent loss, gives the true contents in water.

Argument in favor of including hygroscopic water in summation.—The question has been asked: "If the so-called hygroscopic water is not always such, but not infrequently includes combined water, why is not its determination and separate entry in the analysis entirely unnecessary? Why make a distinction which, after all, may not be a true one?" The question involves the further consideration of the advisability of including in the analysis at all the loss at 100° or 110° C. Many petrographers desire to have all analyses referred to a moisture-free basis, in order that they shall be strictly comparable, and therefore would omit the "hygroscopic" water from the list of constituents. This would be eminently proper were it always possible to be sure that the loss at 100° truly represents mechanically held water. Since it very often represents more, and the determination as to whether or not it does in each case is not always possible, and would add to the time required for the analysis, it seems necessary to include this water. What errors may arise from its exclusion the following rather extreme case well illustrates: Certain rocks of Wyoming in powder form lost from 1 to 2 per cent of moisture at 110°. That not even an appreciable fraction of this was truly hygroscopic the fact of the uncrushed rocks losing the same amount fully demonstrates; yet the rule followed by many chemists and petrographers would have involved the removal of all this water as a preliminary to beginning the analysis, and not only would a most important characteristic have passed unnoticed, but the analyst would have reported an incorrect analysis, inviting to false conclusions and possibly serious confusion.

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[1] Bull. Soc. Min., Vol. XIX, pp. 14, 94, 1896; Comptes Rendus, Vol. CXXII, p. 1006, 1896.

Separate entry of hygroscopic and combined water.—To revert now to the primary question, it may be said that the estimation of the loss at 100° or 110° C. and its separate entry in the analysis is advisable as not infrequently affording at once to the lithologist an indication of the mineral character of one or more of the rock constituents, thus perhaps confirming the microscopical evidence or suggesting further examination in that line. An unusually high loss at 100° would be regarded as probable evidence of the presence of zeolites or other minerals carrying loosely combined water. It has been objected that the true hygroscopic moisture varies with the degree of comminution of the sample and with the condition of the air at the time of weighing, and that it is therefore improper to incorporate it in the analysis; but this variation is ordinarily not at all great. Perhaps the time may come when it will be the rule to ascertain by additional heating at a higher temperature whether the water lost at 100° is to be regarded as purely hygroscopic. In such case it would be proper to omit it, and a distinct advance would undoubtedly be scored.

Is all true hygroscopic water expelled at 100°?—It has been tacitly assumed in the foregoing that true hygroscopic water can all be expelled at 100°, which perhaps is not to be accepted as universally true. Eminent authority holds that it is impossible, in the cases of certain foliaceous minerals, notably the micas, to thus entirely remove it, but that a part is only driven off at higher temperatures. If this is true a further uncertainty is introduced in its determination, which not only strengthens the argument in favor of entering all water in the tabulation, but also serves to emphasize the difficulties of the situation.

APPARATUS FOR THE DIRECT DETERMINATION OF WATER AT DIFFERENT TEMPERATURES.

A form of drying oven devised by Dr. T. M. Chatard[1] is in use in this laboratory for determining water at different temperatures up to 350° C., and gives entire satisfaction. It is an asbestos-covered copper box, shown (B) in different aspects and parts in the accompanying fig. 3. The box is so constructed that the tube with its contents can be removed without detaching from either the drying or collecting tubes, which is a great advantage if it is desired to afterwards apply the direct heat of a lamp in order to expel the water retained at 300° to 350° C. To facilitate this removal the stand is on rollers, so that after clamping the projecting end of the tube and removing the front of the box F and the little side pieces S closing the horizontal slits, the oven can be rolled bodily backward, leaving the tube and its attachments in their original position ready for further heating over a burner or blast. The removable front F of the oven is made of two pieces of sheet asbestos board stiffened by an interlaid piece of sheet copper. The inner piece of asbestos board fits snugly into the box, while the outer one, being slightly larger, by its projecting edges hinders the door from falling in and helps to prevent air currents. This door is held in place by the metal rod R. The little slides S are made in a somewhat similar manner, and are intended to slip in from the front and close the two openings O after the tube is in place, but before closing the front.

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[1] Am. Chem. Jour., Vol. XIII, p. 110, 1891; Bull. U. S. Geol. Survey No. 78, p. 84.

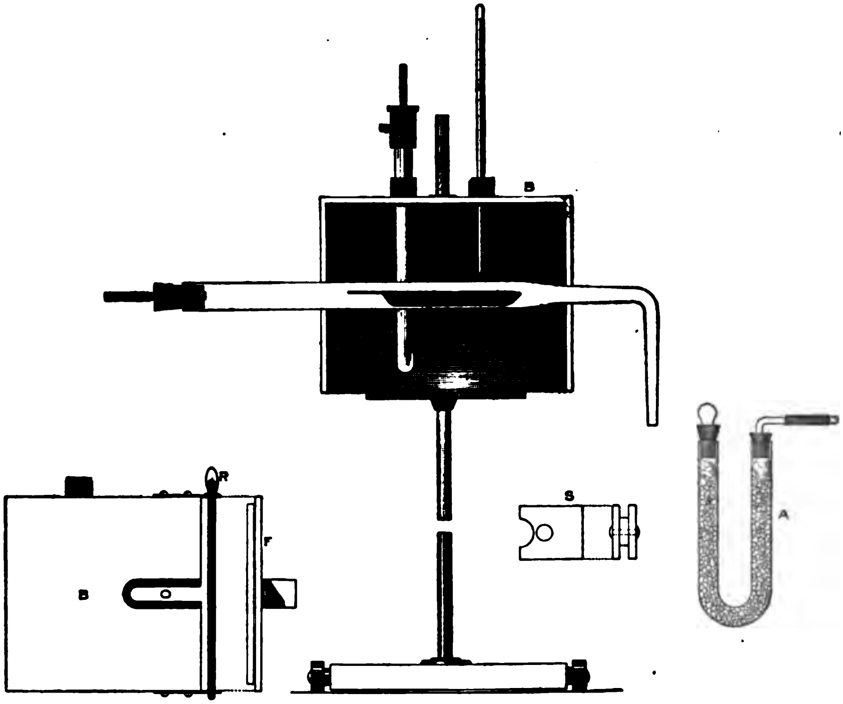

Fig. 3.—Chatard's form of drying oven for water determinations. B, copper box, 18cm. long, 10½cm. high, 9cm. wide, open in front, its sides and top covered with asbestos board; S, two slides of different sizes to close the openings O, after the tube is in position; F, asbestos-board front stiffened by an interlaid sheet of copper; R, metal rod to hold front in place; A, calcium chloride absorption tube.

For other forms of tubes adapted to similar determinations, see pages 40 and 46.

V. WATER—TOTAL OR COMBINED.

ARGUMENTS AGAINST "LOSS ON IGNITION" METHOD.

In a few cases the simple loss on ignition of a rock will give the total water with accuracy, but in the great majority there are so many possible sources of error that this old-time method can rarely be used with safety. Only when the rock is free from fluorine, chlorine, sulphur, carbon, carbon dioxide, and fixed oxidizable constituents can the loss be accepted as the true index of the amount of water present, and it is rarely that a rock is met with fulfilling these conditions, especially as to the absence of ferrous iron. Blast ignition in presence of carbon dioxide alone of the above list may give a correct result, after separate estimation of the carbon dioxide, provided this emanates from carbonates of the earths and not from those of iron or manganese. The long-maintained and still upheld idea that in presence of ferrous iron a sufficiently correct result is obtainable by adding to the observed loss an amount needed for oxidizing all ferrous iron is not justifiable. There can be no certainty that the oxidation has been complete, especially in the case of readily fusible rocks, and at the high temperature of the blast a partial *reduction* of higher oxides is not only possible but sometimes certain. The inability to insure complete oxidation by simple ignition is illustrated in the case of precipitated ferric hydroxide which has been ignited in contact with its filter paper. If the quantity was in any degree large it is sometimes decidedly magnetic, presumably from presence of magnetic oxide, which no amount of heating wholly oxidizes, especially in the larger grains. Neither is evaporation with nitric acid and reignition sufficient to destroy the magnetic property of the oxide, as has been claimed.

Direct weighing of the water evolved is then imperative in most cases, and of the numerous methods advocated, or in general use, several will now be considered.

DIRECT WEIGHING OF THE WATER WITHOUT THE USE OF ABSORPTION TUBES—PENFIELD'S METHODS.

For minerals easily deprived of their water.—If no other volatile constituents than water are present, the beautifully simple method first used by Prof. G. J. Brush and extended by Prof. S. L. Penfield[1] leaves nothing to be desired for accuracy. It consists simply in heating the powder in a narrow tube of hard glass, enlarged at the closed end and provided with one or two further enlargements in the middle to hold the water and prevent its running back and cracking the hot glass. A capillary glass stopper fitted in with rubber tubing prevents loss of water by circulating air currents. The tube being held horizontally, the bulb is heated to any required degree by the Bunsen or blast flame. Moistened filter paper or cloth wound about the cooler parts of the tube insures condensation of all water. The heated end being finally pulled off, the tube is weighed after cooling and external cleansing, and again after the water has been removed by aspiration. For most rocks, as they contain little water, central enlargements of the tube are hardly needed.

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[1] Am. Jour. Sci., 3d series, Vol. XLVIII, p. 31, 1894; Zeitsch. für anorg. Chemie, Vol. VII, p. 22, 1894.

Various forms of tubes used by Penfield are shown in fig. 4.

Before using, even if apparently dry, "these tubes must be thoroughly dried inside, which is best accomplished by heating and aspirating a current of air through them by means of a glass tube reaching to the bottom."

How this simple tube is made to afford entirely satisfactory results

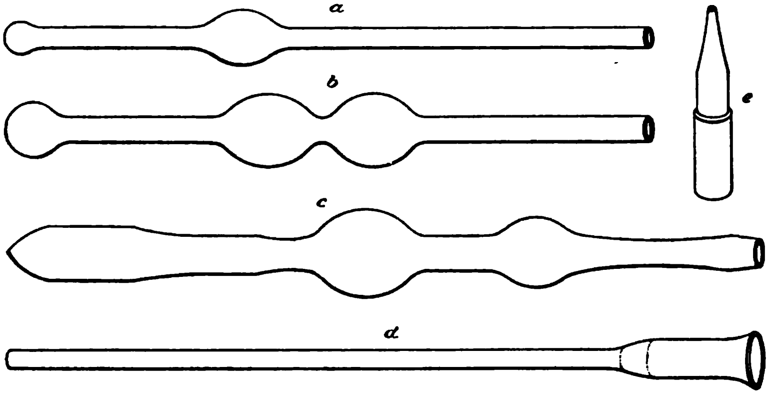

FIG. 4.—Penfield's tubes for water determination in minerals. *a*, *b*, *c*, different forms of tubes; *d*, thistle tube for introducing the powder; *e*, capillary-tipped stopper.

with minerals, even when carbonates are present, is fully set forth in the paper cited.

Few rocks, comparatively, are altogether free from other volatile constituents. Hence, for refined work the application of this apparatus in the simple manner above set forth is limited. It may, however, be used with the addition of a retainer for fluorine, sulphur, etc., such as calcium, lead, or bismuth oxides.

For minerals not easily deprived of their water.—When minerals are present which do not give up their water wholly, even over the blast, as talc, topaz, chondrodite, staurolite, etc., Penfield's simple combination of fire-brick and charcoal oven, depicted in fig. 5, must be used, either with or without a retainer for fluorine, as circumstances demand. The part of the tube in the fire is to be protected by a cylinder of platinum foil tightly sprung about its end, and the part outside by asbestos board, as well as by wet cloth or paper. A piece of charcoal is likewise laid on the tube, as well as beneath and behind, and the blast flame is given a horizontal direction, so as to play upon the side of the apparatus. In this way a most intense temperature can be reached.

In whichever way the apparatus may be used, the water found is

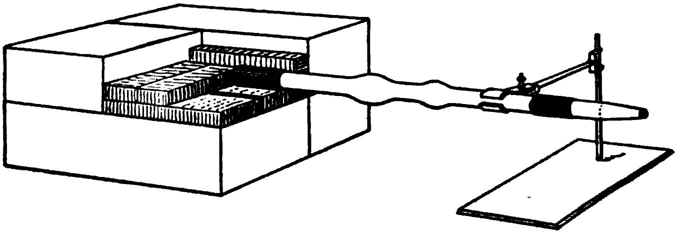

FIG. 5.—Penfield's fire-brick and charcoal oven for use in determining water.

the total water, from which that found separately at 105° C. may be deducted if desired.

DIRECT WEIGHING OF THE WATER IN ABSORPTION TUBES.

Penfield's procedure.—The simplest of these methods as to apparatus, and one permitting, by the use of auxiliary arrangements such as are shown and described on page 37, the determination of the hygroscopic as well as any other fraction of the water, is the following glass-tube arrangement (fig. 6) of Dr. Penfield's,[1] whereby the brick and charcoal oven already referred to (fig. 5) comes again into play, but without the half brick shown in that figure.

The tube is of about 15 mm. internal diameter, and is fitted with two platinum cylinders at A, one inside, the other outside, where the heat exposure is to be most intense.

These are made from pieces of platinum foil, about 0.07 mm. in thickness and 8 by 11 cm. in diameter, which have been previously bent around glass tubes of such

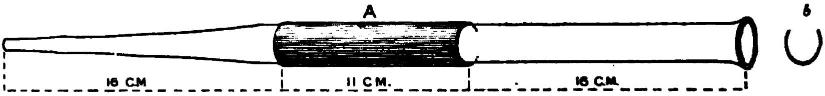

FIG. 6.—Tube for water determination according to Penfield. A, outer protecting covering of platinum foil. A second similar foil on the inside prevents the glass from collapsing when heated to softness. *b*, cross-section of platinum boat.

a size that when applied to the combustion tubing the spring of the metal will hold them in place. A large platinum boat, 7 to 8 cm. long and 11 to 12 mm. in diameter, with a cross-section like *b*, should be used, since this will readily hold a gram of mineral mixed with 5 grams of sodium carbonate. * * * The tube is placed in the angle formed by the charcoal lining, some pieces of charcoal are placed at the sides in front, leaving an opening through which the flame may be directed, and an additional piece is laid on top. The tube can readily be brought to a full white heat, and by forcing a slow current of dry air through the apparatus the carbon dioxide resulting from the decomposition can be removed and the water carried over into the weighed absorption tube. The glass fuses between the platinum casings, and in a number of experiments that have been tried there has not been a single instance where the glass tube has broken or shown any indication of breaking. After heating the tube will not crack if it is left to cool slowly on the charcoal, but it can not be used a second time. * * * At the high temperature to which the glass is subjected it of course becomes very soft and the ends must be properly supported; also the rubber connections and absorption apparatus must be carefully screened by asbestos board. By constructing a cover for the boat no material need be lost by spattering, and after making the water determination the contents may be used for the remainder of the analysis.

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[1] Am. Jour. Sci., 3d series, Vol. XLVIII, p. 37, 1894; Zeitsch. für anorg. Chemie, Vol. VI, p. 22, 1894.

The inner cylinder of platinum serves to prevent the glass from collapsing as it softens, whereby distortion of the boat would result and its withdrawal for further examination of its contents would be impossible.

Gooch's apparatus.—Of more elaborate apparatus, designed to be used with fluxes, the tubulated platinum crucible invented by Dr. Gooch[1] is capable of affording most excellent service, and it is the one by which far the larger number of water determinations in this laboratory have been made.

Fig. 7, which hardly needs detailed description, shows it in a modified form, which differs from the original forms of Gooch in that the tubes for connecting with both the drying and absorption vessels are constructed wholly of platinum instead of lead glass, the vertical one being bent horizontally at right angles for convenient attachment to the drying towers, and the side one also bent at right angles, but downward, and having its end slightly drawn in at E (fig. 7) so as to admit of easy insertion in the rubber stopper of a U-shaped calcium-chloride tube, as shown in fig. 9 (p. 44). With tubes of the lengths shown in the figure there is absolutely no danger of their ends becoming hot enough by conduction to scorch or soften the rubber stopper or other connection.

The extra first cost of the platinum extension to these tubes over the lead-glass ends of Gooch's original and modified forms need hardly enter as a factor into the question of employment of this apparatus. The glass ends often break, and only a rich lead glass, not easily obtainable, can be used, since it alone will not crack at the joint with the platinum after cooling. In its present form the whole apparatus weighs approximately 88 grams.

As an adjunct to its convenient use there is needed an ordinary upright iron ring-stand, with two small sliding rings, and a sliding ring-burner provided with entering ducts for gas and air blast. Across the uppermost ring there is an arrangement of stout platinum wire (S, fig. 8), forming at the center of the ring a secure seat for the upturned flange of the crucible proper. Both rings and burner can be clamped firmly at any height.

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[1] Am. Chem. Jour., Vol. II, p. 247, 1880; Chemical News, Vol. XLII, p. 326, 1880.

The rock powder, having been placed in the cylindrical crucible (C, fig. 7), is there mixed with not more than 3 or 4 grams of fully dehydrated sodium carbonate,[1] or more of lead chromate if carbon is to be likewise determined. The crucible is sunk in its seat S (fig. 8) in the upper ring R′ and the tubulated cap T (fig. 7) is fitted on and attached to the calcium chloride drying towers—preceded by one containing potassium hydroxide if carbon dioxide is likewise to be estimated—on

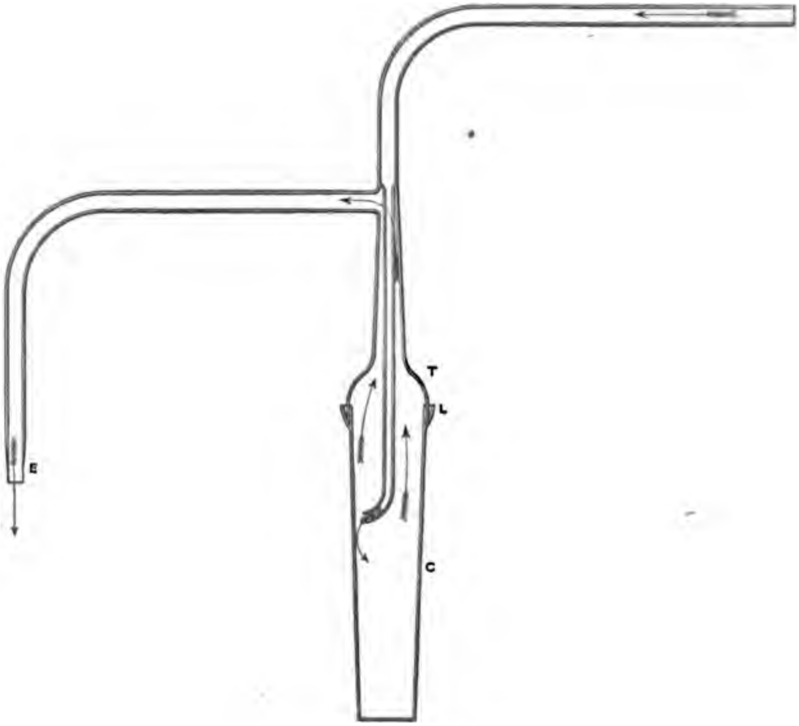

FIG. 7.—Modified form of the Gooch tubulated platinum crucible for the determination of water, one-half natural size. Weight about 88 grams.

the one side, and to a sulphuric-acid bulb tube B (fig. 9) on the other. Powdered sodium tungstate—free from arsenic, which would soon ruin the crucible lips—is now poured into the flanged lip L (fig. 7) in which the cap rests, and a metal vessel of cold water having been raised up by the lower ring R″ (figs. 8 and 9) until the platinum crucible is sufficiently immersed, the flame of an ordinary blast lamp is turned on to melt the tungstate. As soon as this is fused the flame is removed and the salt solidifies and makes an air-tight joint, the test of which is the permanence of the column of sulphuric acid in the bulb tubes caused by the contraction of the air in the platinum apparatus as it cools.

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[1] This has been heated for a length of time to near its fusing point over a free flame or in an air bath, to decompose the bicarbonate it usually contains, and then placed in a desiccator. Thus heated it is not very hygroscopic. Penfield found that 2.5 grams of it, spread out on a watch glass, gained only .0002 gram in 15 minutes. Potassium carbonate and potassium-sodium carbonate are too hygroscopic by far to be available.

After drying by a current of air at 105° C. for two hours, more or less (see below, p. 45), by means of an air or toluene bath, as shown in fig. 8, the absorption tube A (fig. 9) is interposed between the sulphuric-acid bulbs and the apparatus, being fitted to the latter by its stopper, which is at other times closed by a glass plug, and while a slow

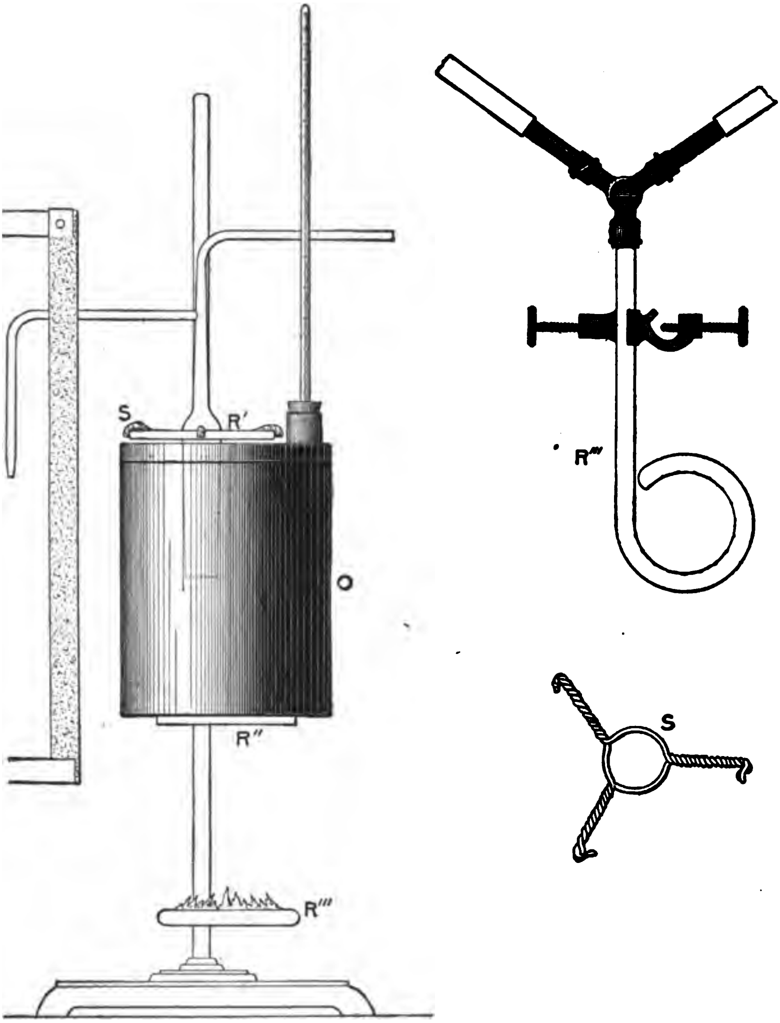

FIG. 8.—Details of the Gooch crucible for determining water. S, seat of stout platinum wire resting on ring R′, and serving as a support for the crucible; R‴, blast-fed ring burner; R″, support for air or toluene bath O.

current of air continues to pass the gradual heating and subsequent fusion of the flux is brought about by the blast-fed sliding ring-burner R‴ (figs. 8 and 9). The sodium-tungstate joint is shielded from the flame by small pieces of asbestos board P (fig. 9), cut out so as to fit the crucible. When fusion is complete, as shown in the case of sodium-carbonate flux by the decided slackening of the gas current through the safety bulbs attached to the drying tube, the flame is extinguished and a current of air is allowed to continue until the apparatus is cold.

This apparatus suffers from the drawback of being slightly permeable

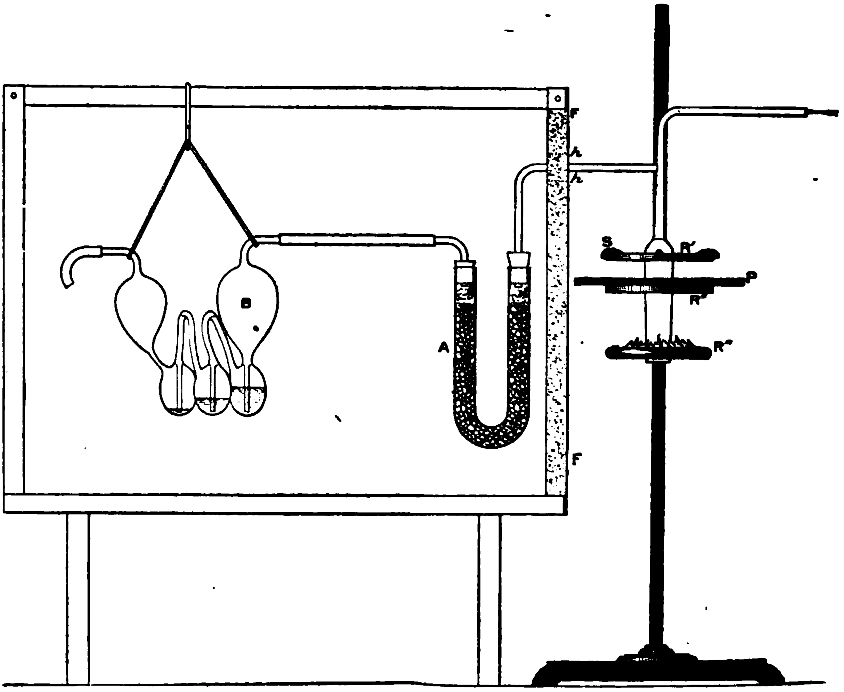

FIG. 9.—Arrangement during fusion of Gooch apparatus for determining water. R‴, blast-fed ring burner; P, protective asbestos-board shield resting on ring R″; FF, board forming end of frame and covered with asbestos board to prevent being set on fire by the heat of the blast. This serves at the same time as an efficient shield for the absorption tube A. In it there is bored a round hole at AA, through which passes the outlet tube from the crucible. B, sulphuric-acid bulbs serving to show the rate of gas current through the absorption-tube and at the same time to prevent back entry of moisture from the air into A.

to combustion gases at high temperature. The defect can be overcome by causing the flame to play upon an outer ordinary platinum crucible, kept permanently filled with sodium-potassium carbonate. This protective crucible, however, is soon ruined for other purposes, being distorted by the alternate expansion and contraction of the carbonate.

It has been found that if the operation is carried out expeditiously and the final full heat applied for but a few minutes the error due to penetrating water gases is inappreciable. This hastening may be rendered safer by using rather finely powdered calcium chloride in the central section of the U-shaped absorption tube to avoid large air channels. Through this, or any apparatus based on similar principles, the air current should always be forced, not drawn. A warm blast directed upon the exit tube near its entrance into the absorption tube greatly shortens the time required, and is to be recommended.

In this apparatus only the water expelled above 100° to 110° should as a rule be determined, and to effect drying of the mixed mineral powder and sodium carbonate, after luting the tubulated cap on the cylindrical crucible with sodium tungstate, the tube is sunk through a round hole in the cover into a small cylindrical air bath (fig. 8), which can be heated from beneath by the same ring burner which is subsequently to fuse the flux. A slow current of air is then forced through, and the drying satisfactorily accomplished.

The reason why it is unsafe to attempt estimation of "hygroscopic" moisture in this apparatus is, that the luting of the two parts must be done by direct application of a flame to the tungstate, and considerable water vapor may enter the apparatus and be in part retained by the dried sodium carbonate.

Chatard's apparatus.—The platinum apparatus devised by Dr. Chatard[1] overcomes the permeability of the metal to gases and affords sharp results, moreover permitting of determining by direct absorption not only the hygroscopic water, but that which may be driven off at any desired temperature, either with or without fluxes. It is, however, perhaps even more costly than the Gooch apparatus, and the supposed nonliability to injury by warping, because of the protective layer of borax and asbestos, can hardly be considered as proved.

Merits of the above three forms of apparatus.—All of these apparatus, except the glass tube of the modified Brush method, permit of the estimation of other constituents besides water in the same portion if necessary; and by the use of lead chromate or potassium chromate, instead of sodium carbonate, graphite, or the carbon of organic matter, can be simultaneously determined with the water.

To one accustomed to its use, and with a drying and suspension attachment permanently set up, the Gooch apparatus, considering its limitations above set forth, offers perhaps the most handy and convenient means for the determination of water in rocks. Its high first cost, in comparison with the glass tube, is fully made up in time by its durability.

Jannasch's methods.—This zealous deviser of methods for mineral analysis has published in the Zeitschrift für anorganische Chemie and the Berichte der deutschen chemischen Gesellschaft several papers dealing with the problem of water determination in minerals, and in his text-book[2] these are collected in more or less modified form.

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[1] Am. Chem. Jour., Vol. XIII, p. 110, 1891; Bull. U. S. Geol. Survey No. 78, p. 84, 1891.

[2] Praktischer Leitfaden der Gewichtsanalyse. Leipzig, von Veit & Co., 1897.

For the majority of silicates he finds dehydrated borax powder a most efficacious flux, usually at a very moderate temperature. The fusion is accomplished either in a platinum boat within a glass tube or in a tube of the form and dimensions shown in the accompanying fig. 10.

For rocks or minerals containing not much fluorine a retaining layer of granular lead chromate, or of previously fused and powdered lead oxide, is used as shown at *a*. Plugs of glass wool are used at *c*, *c*. Whether or not the boat is employed the borax is first introduced and, together with the retainer, is thoroughly dried out in an asbestos oven by a hot-air current. Then, after cooling, the mineral powder is added and thoroughly mixed with the borax. Heat is applied by a flat flame to the mixture, which soon melts and forms a clear fusion, when the action is complete. The blast may be used in extreme cases. The layer of retainer must be kept warm by an auxiliary flame, and the absorption tube must be removed before the flame under the fused mass is extinguished, for the glass breaks as soon as this is done. Carbon dioxide can simultaneously be determined by attaching a soda-lime tube to the calcium-choride tube. For one-half to 1 gram of silicate Jannasch uses 1½ to 2 grams of borax.

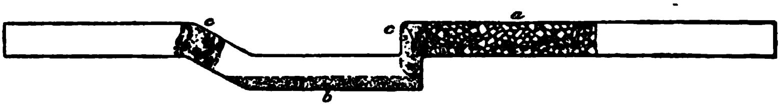

FIG. 10.—Glass tube for determination of water (Jannasch). *b*, mixture of mineral powder with borax; *c*, *c*, plugs of glass wool; *a*, layer of lead chromate or lead oxide. Total length of the tube, 33 cm.; inside diameter, 12–14 mm.

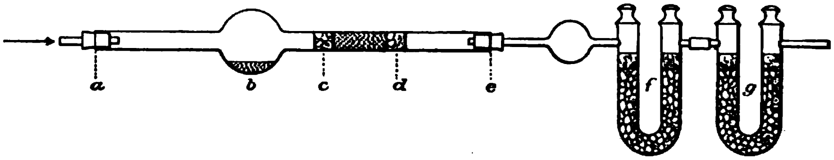

FIG. 11.—Glass tube for determination of water in special cases (Jannasch). Length from *a* to *e*, 26 cm.; inside diameter somewhat over 1 cm.; volume of bulb *b*, 25 cm^3. *c*, *d*, retaining layer of lead oxide between plugs of glass wool; *f*, calcium choride absorption tube; *g*, protective tube.

Regarding the borax method, its inventor insists upon the following points as essential to success, especially when the blast can not be applied: Most thorough mixing of flux and mineral powder and a most impalpable fineness of the latter.

The borax itself is prepared by heating pure crystallized borax in a platinum dish till a small portion has melted. That remaining unfused is powdered and again heated in the dish to dull redness for fifteen minutes, with constant stirring. The powder is placed in a tube with tightly fitting glass stopper and kept over sulphuric acid. It must not be kept long without reheating, because of being hygroscopic.

Another form of tube used by Jannasch for special purposes is shown in fig. 11. Minerals, such as topaz, which is not fully decomposed by the borax method and which contains a large amount of fluorine, are fused at *b* with about six times their weight of lead oxide. A layer of lead oxide between *c d* serves to retain any fluorine escaping from the fusion.

VI. SILICA, SEPARATION FROM ALUMINA, ETC.

ALTERNATIVE METHODS OF DECOMPOSITION.

PRELIMINARY REMARKS.

The practice of separating alumina, etc., by the usual methods, after first attacking the rock powder by hydrofluoric and sulphuric acids—silica being estimated in a separate portion—while attractive in principle, was abandoned by the writer after fair trial, owing to the disturbance sometimes occasioned by incomplete expulsion of fluorine and to a less degree by the presence of sulphates instead of chlorides. With exception of the comparatively few analyses made thus, the sodium-carbonate method has always been employed. In the case of rocks rich in fluorine strict accuracy would require the separation of silica to be made as in the Berzelian method for fluorine estimation (see footnote, p. 50), but in practice it is not often necessary to resort to this tedious procedure, since the amount of fluorine is usually small and it can by no possibility cause a loss of much more than three-fourths its own weight of silica by volatilization as silicon fluoride when the sodium-carbonate fusion is evaporated directly with hydrochloric acid. Probably the loss is less, since some fluorine perhaps escapes as hydrofluoric acid. However this may be, the error is of comparatively slight importance, since it attaches to the constituent always present in greatest amount.

Various fluxes other than alkali carbonates have been recommended for breaking up silicates insoluble in ordinary acids, such as lead and bismuth oxides, lead carbonate, borax, and boric oxide. Professor Jannasch and his pupils have been especially active of recent years in this line of work, as evidenced by their numerous published papers. One of the advantages these fluxes possess over the alkali carbonates is their removability after serving their purpose, thus allowing the various separations to be made more perfectly and without the annoying interference of several grams of foreign fixed salts, which are most troublesome in that part of the analysis devoted to the separation of silica, alumina, iron, lime, and magnesia.

Another of their advantages is that with some of them it is possible to estimate in one portion the alkalies, in addition to those constituents usually determined in the silica portion. Where the material is limited, as it so often is in mineral analysis, this is a most important advantage, sufficient to outweigh all possible objections; but in rock analysis, where the supply of material is usually ample, it is rarely worth considering. A still further point in their favor is that it is probably more easy to obtain them entirely free from fixed impurities than an alkali carbonate.

There are, however, objections to their use. With some of them an extraordinary amount of time must be devoted to grinding the mineral to an impalpable powder, and the flux itself may need considerable hand pulverization. Once introduced, they must be removed before the analysis can be proceeded with, and this removal takes much time and is always a possible source of error.

In mineral analysis these objections are entitled to far less weight than in rock analysis, since the object sought—usually the deduction of a formula—warrants the expenditure of much time and painstaking care. Finally, it has been found that one or more of these fluxes are not available for altogether general use, since certain minerals do not fully succumb to their attack under simple conditions, as andalusite with boric oxide and others with lead oxide (Jannasch). Therefore, however well adapted one or the other of these methods may be for the analysis of homogeneous minerals, it is very improbable that the vivid anticipations of Professor Jannasch, to the effect that the boric-oxide method will soon supersede the alkali-carbonate fusion method in rock as well as in mineral analysis, will be speedily realized. Nevertheless, the boric-oxide fusion method, owing to its evident merit, will be described in detail after brief reference to a means of bringing refractory silicates into solution without employing any solid reagent.

DECOMPOSITION OF REFRACTORY SILICATES BY HYDROCHLORIC ACID UNDER PRESSURE.

Jannasch[1] pours upon the finely ground rock powder contained in a platinum tube of about 26 cm.^{3} capacity a somewhat diluted hydrochloric acid (4 acid to 1 water), places over the open end a cap which does not hermetically close the tube, inserts the latter in a larger one of potash glass likewise partially filled with the diluted acid, seals the glass tube, and places it in turn in an inclined position in a steel Mannesmann tube containing ether or benzine to equalize the pressure, and heats to any desired temperature up to 400° C.

The chief drawback seems to be a somewhat incomplete decomposition, doubtless due to the necessarily inclined position of the tube, which causes the powder to collect at the lower end, and thus renders decomposition less complete than if the material were spread evenly throughout the length of the tube. Further, the acid strongly attacks the platinum unless the air in both the platinum and the glass tubes is replaced by carbon dioxide. Even when this is done, several milligrams of platinum are found in the silicate solution.

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[1] Ber. deutsch. chem. Gesell., Vol. XXIV, p. 273, 1891, and Zeitschr. für anorg. Chem., Vol. VI, p. 72, 1894.

Nevertheless, to those possessing the necessary platinum and steel tubes the method can render efficient service in special cases when economy of material is imperative.

THE BORIC OXIDE METHOD OF JANNASCH AND HEIDENREICH.[1]

Preparation of the boric oxide.—This demands, if the alkalies are to be estimated in the same portion as silica, etc., an absolutely alkali-free boric acid, which can be prepared by two or three recrystallizations of a good commercial article. The purified crystals are dehydrated and fused in a large platinum crucible. This is then suddenly cooled to cause the anhydride to crack into pieces of a size convenient for powdering, which are to be kept in a tight glass and powdered as needed, since the anhydrous oxide is hygroscopic.

Treatment of easily decomposable silicates.—To this flux Jannasch and Heidenreich find that nearly all silicates readily succumb over the ordinary blast lamp. The fusion is made in a large crucible holding 40–65 cm.^{3}, and the proportion of flux to be used is gauged according to the nature of the silicate, ranging from 3 to 8 and more parts to 1 of mineral. This last must be finely powdered, especially the most resistant, the authors recommending the expenditure of one-half to one hour's time for the grinding of one-half to 1 gram of powder. A low burner heat is applied for five to ten minutes till water is expelled, which is then gradually increased till the gas is fully turned on. Bubbling and rising in the crucible is prevented as far as possible by using a short platinum rod which does not reach above the edge of the crucible. When the mass has been in quiet fusion for a time in the covered crucible the blast flame is applied. The average duration of the entire operation is twenty to thirty minutes, but depends much on the character of the mineral.

Treatment of refractory silicates.—For those minerals which, like andalusite, cyanite, and topaz, are not fully decomposable by the heat of the ordinary blast flame, Jannasch and Weber[2] use a flame fed by oxygen instead of air. The blast lamp, of 2½ mm. opening, is supplied with gas from at least five or six ordinary gas cocks, and the flame is made broad and free from luminosity. The mineral having been first heated as above described, but with a much larger proportion of flux—as high as 30 to 1—a few grams additional of boric oxide are added and the oxygen blast is applied till, in ten or fifteen minutes, the fusion is as transparent as glass.[1]

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[1] Zeitschr. für anorg. Chem., Vol. XII, p. 208, 1896.

[2] Ber. deutsch. chem. Gesell., Vol. XXXII, p. 1670, 1899.

Further treatment after fusion.—From this point the further treatment is the same in both cases, and as modified by Jannasch and Weber (loc. cit.) is as follows:

The hot crucible is cooled in cold water and the contents are turned into a very large porcelain or platinum dish, to which, after covering with a glass, a saturated solution of hydrochloric acid gas in methyl alcohol is added.[2] The cover being then removed, the liquid is heated to boiling over asbestos board by an inch-high flame, stirring constantly, or it is left without attention over a lower flame or on a water bath heated short of boiling. The crucible is cleansed in a similar manner, and its contents are added to the dish. In ten to fifteen minutes, with occasional addition of the methyl chloride, solution is complete and the liquid is then boiled down to a small volume and evaporated to dryness on the bath. The residue is then digested on a bath at 80° to 85° C. three or four times in succession, with the ether solution, in order to remove the last traces of boron as boric ether. Care should be taken to wash down from the sides of the dish, with methyl-chloride solution, the boric acid formed and deposited thereon during the evaporation.

Possible objections to the boric-oxide method.—Very much is claimed by Jannasch for this method, but with all its undoubted merit there are two points which may militate against it in time. The boric ether, driven off in such enormous quantities, at once decomposes in contact with moisture, and boric acid settles over all objects with which it comes in contact. The hood must become thickly coated. Hence a special hood for these evaporations alone seems to be called for, otherwise boric acid may at any time fall into other dishes and cause untold trouble. The second objection attaches to the use of the oxygen flame when alkalies are to be estimated in the fusion, and the ability to so determine them is one of Jannasch's chief claims in favor of the method, for it can not be doubted that at the high temperature of this flame alkalies are volatilized in part. Borax can be slowly but wholly volatilized over the ordinary blast, hence there is great reason to fear sufficient loss at this much higher temperature to give rise to serious error at times.

THE SODIUM-CARBONATE METHOD.

Purity of the sodium carbonate used as a flux.—Notwithstanding the most earnest efforts for years, it has been impossible to procure, either in the open market or by special arrangement with manufacturers, an article of sodium carbonate which can be called chemically pure. With special precautions small lots can be prepared in the laboratory that will contain less than 1 milligram total impurity in 10 grams; but such an article can not be purchased in the market, and rarely will the so-called chemically pure dry sodium carbonate contain as little as 1 milligram in 10 grams. The invariable contaminating substances, aside from sand and straw, which have sometimes been found in large amount, are silica, alumina, iron, lime, and magnesia, all of these going into aqueous solution with the carbonate. The chief of these impurities are usually silica, alumina, and lime. An article of the above degree of purity is satisfactory in almost all imaginable cases, since the use of the usually extravagant amount of 10 grams for a fusion would introduce an error of but 0.1 per cent in the analysis, supposing 1 gram of mineral to be operated on, and it would, moreover, be distributed over several constituents. This error is undoubtedly fully equaled by the introduction of dust from the air in the various long evaporations.

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[1] An interesting and important observation reported by Jannasch and Weber is that when the oxygen blast has been used for silicates carrying fluorine or mixed with fluorides, the fluorine seems to be wholly expelled as boric fluoride, without loss of silica. If this should prove to be generally true, an easy way is at last afforded for estimating silica in such cases, where even its detection when present in small amount, has heretofore been difficult.

[2] Made by passing dry HCl into cooled CH_4O for from one to two hours.

Precautions in fusing.—Special directions with regard to the fusion and its first treatment are unnecessary, except to say that ordinarily from 4 to 6 parts of flux should be used to 1 of rock and that the flame should not be directed vertically against the bottom of the crucible, but at an angle against the side and bottom, nor should the flame be allowed to envelop the whole crucible. These precautions apply in all ignitions of reducible substances, and yet they are rarely observed. In neither case, if neglected, will there be the necessary oxidizing atmosphere within the crucible; on the contrary, reduction may occur fraught with serious consequences. This is especially true if the rock contains more than traces of pyrite or other sulphide, when, after cleansing and igniting the crucible, there may appear on its interior a darkening due to oxidation of reduced iron which had alloyed with the platinum. This may in exceptional cases amount to several milligrams in weight, and can be removed only by repeated ignitions, followed each time by scouring or treatment with hydrochloric acid or acid potassium sulphate. In order to avoid the use of niter in case of pyritiferous rocks, it is well to first roast the weighed powder in the crucible in which the fusion is to be made.

Treatment after fusion.—When fusion is complete, the crucible is seized with the tongs (fig. 1, p. 23) and the contents are caused to solidify in a thin sheet over the sides and bottom by imparting an appropriate rotating motion with the arm during the cooling process. This is far preferable to allowing the melt to form a thick cake at the bottom, since much less time is required for disintegration, and separation from the crucible is usually much easier.

It sometimes happens that the cooled flux, and even its solution, will indicate absence of manganese when it is really present in quantity to give normally a strong coloration. Two fusions made side by side or successively, under apparently similar conditions, may in one case show little or no manganese, in the other considerable. This observation has been frequently made, and therefore the absence of a bluish-green color in the fusion is not to be taken as proof of the absence of manganese. This difference of behavior I can ascribe to no other cause than that of a reducing atmosphere in one of the crucibles and an oxidizing one in the other, even though the conditions were apparently alike.

The contents of the crucible are placed in a rather tall covered beaker with some water, and hydrochloric acid of 1.1 specific gravity is added in excess. The depth of the pink color usually produced on addition of the acid allows of judging approximately as to the amount of manganese present. The beaker is placed on the water bath, and when disintegration is complete, having been assisted by gentle pressure with a blunt glass rod, the contents are transferred to a large platinum dish and evaporated on the bath.

SUBSEQUENT TREATMENT.

From this point the treatment will ordinarily be the same whether the boric-oxide or the sodium-carbonate method of decomposition has been employed.

Drying and testing of silica.—As to the best way of rendering silica insoluble by evaporation, the writer's predilection is for a double evaporation instead of a single one on the water bath. By fusing with sodium carbonate in the forenoon, the silica is ready for the first filtration in the afternoon. It is quite unnecessary to carry the evaporation beyond approximate dryness. The filtrate is again evaporated, always in platinum, and is ready for final filtration the following morning, when approximately 1 per cent of silica is recovered and added to the main portion. The writer's experience is that a better separation of silica is effected hereby, and in no more time than by a single long evaporation. That which is subsequently recovered from the precipitate of alumina, etc. (p. 56), rarely exceeds a half or, at the most, 1 milligram.

Drying in an air bath at 110° C. or higher, or on a hot plate or sand bath, or over a free flame, in order to render silica insoluble, offers no advantage unless much magnesium is present, and then the most favorable temperature, according to Gilbert,[1] is 120° C. The presence of much calcium chloride seems to facilitate dehydration of the silica, while magnesium chloride above 120° C., on the other hand, by decomposing, forms a silicate which dissolves in hydrochloric acid and

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[1] Technology Quarterly, Vol. III, p. 61, 1890. Abstract in Fresenius's Zeitschr. für anal. Chemie, Vol. XXIX, p. 688, 1890.

[Insert for Bulletin No. 176 (reprint), U. S. Geol. Survey; to face page 53.]

(July, 1902.)

ADDITIONAL NOTES ON THE BEHAVIOR OF SILICA.

The statements of a few earlier writers that silica can not be wholly recovered from solution by a single evaporation with acid and filtration, no matter how prolonged the drying may be or at what temperature, have been shown to be fully justified in the author's paper, "Common Errors in the Determination of Silica" (Jour. Am. Chem. Soc., Vol. XXIV, pp. 362–374). It is there shown that after a second evaporation on the steam bath, with following filtration, very little silica remains in solution. The solubility of the silica is probably due to a number of causes, one of which is shown to be the direct action on silica of the acid used for dissolving the other constituents of the dry mixture.

In minerals like zeolites, or artificial products, such as cements, which are directly soluble in hydrochloric acid, the drying may be very much hastened by using a wide, flat dish, evaporating to approximate dryness on the steam bath, then placing the covered dish on a triangle which itself rests on a hot plate. The temperature may rise in the dish to 200° C.; in fact, according to Mr. Bertram Blount, it should not be lower. After an hour's exposure to this temperature less silica will perhaps pass into solution than after prolonged drying at steam-bath temperature, but this is usually at the expense of greater contamination of the filtered silica. Since this contamination is very large with highly titaniferous and ferruginous minerals, the operator should use discretion in his choice of a high temperature for dehydrating silica.

In the above-mentioned paper it is further shown that the slight remnant of silica still remaining in solution after two filtrations can not be wholly recovered after fusion of the ignited alumina, etc., by potassium pyrosulphate, when the procedure given near the foot of page 56 of this Bulletin is strictly followed. Under the conditions there prescribed much of any silica present will pass into solution, but if the latter be evaporated with a very large excess of sulphuric acid and heated *till fumes of the acid are copiously evolved*, the silica becomes wholly dehydrated. The large excess of acid is prescribed so that the mass shall not solidify on cooling, but only become pasty. Then it dissolves in great part readily in hot water, and the difficultly soluble aluminum and other salts pass slowly but completely into solution when digested for half an hour or less on the steam bath. The silica is then plainly seen in a flocculent condition. After its separation by filtration the solution may be treated for iron and titanium as usual.

A strong argument in favor of two evaporations and filtrations for silica is that any silica remaining in solution is not, as seems to have been tacitly assumed by chemists, wholly precipitated by ammonia or sodium acetate with the iron and aluminum. It therefore is important to secure its removal as completely as possible at the start, and not trust to recovering the final portions later.

In the paper cited proof is also given to show the need of blasting silica to secure constant weight. Prof. F. P. Treadwell in a private communication reports that, while the heat of the Bunsen burner is insufficient, the blast is unnecessary if a Teclu burner instead of a Bunsen is used.

increases the amount of silica carried into the filtrate. It does not appear from Gilbert's paper that the blast-furnace slags, on which he experimented, contained titanium, phosphorus, or iron in appreciable amounts. Basic magnesian rocks usually do, and in such cases it is probable that the employment of a drying temperature of 120° would materially add to the large impurity always to be expected with the silica. In other cases he confirms the earlier belief that drying temperatures higher than that of the water bath increase the amount of insoluble impurity, chiefly alumina, in the silica, and that this amount can not be reduced by long digestion with hydrochloric acid. Further, he confirms Lindo's statement that evaporation with sulphuric acid till the appearance of white fumes gives a higher result in silica than with hydrochloric acid. But for general rock analysis the use of sulphuric acid at this stage must be rejected utterly.

Blasting for twenty to thirty minutes[1] is necessary to expel all moisture from the silica, and it is then not hygroscopic. Its weight should always be corrected for impurities, which are never absent, by evaporating with hydrofluoric and sulphuric acids and again blasting. If toward the end of evaporation with these acids, when the hydrofluoric acid has been driven off and the sulphates begin to appear in solid form, the residue has a peculiar milky or enamel-like appearance, it may be taken as evidence of much phosphorus and titanium. This appearance is possibly due to zirconium with the phosphorus and titanium,[2] and is so unusual and striking that it is worth while calling attention to it. With basic rocks very rich in titanium and phosphorus the residue may amount to 2 or even 3 per cent of the rock.

The subsequent precipitate of alumina, etc., is usually ignited in the crucible containing the residue from the silica.

It might be supposed that this residue would contain most of the barium of those rocks carrying that element together with sulphur or sulphates, but the reverse is true as a rule. Only when there is a considerable excess of SO_3 over the BaO will much of the latter be found there, and in the vast majority of cases there is none at all. Should some be present, its removal and estimation at this stage is not necessary, as it can be more conveniently recovered later, together with the silica accompanying the alumina, etc., precipitate (p. 56).

The separation of silica in rocks containing fluorine has been touched upon in commenting on the boric-oxide and sodium-carbonate methods of fusion,[3] and will be considered further under the head of Fluorine (p. 103).

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[1] It must be borne well in mind that some platinum crucibles lose weight steadily and very appreciably on long blasting, not only when new but even after long use. When a crucible suffers from this defect the rate of loss should be ascertained from time to time and allowance made accordingly, or else the weight of the crucible should be taken after and not before ignition of the precipitate. (See on this subject Hall, Jour. Am. Chem. Soc., Vol. XXII, p. 494, 1900.)

[2] See first footnote, p. 57.

[3] See p. 47 and footnote, p. 50.

Platinum in filtrates.—The filtrates from the silica always contain notable amounts of platinum. This arises in very small degree from the crucible fusion, in a larger one indirectly from the action of hydrochloric acid on manganate, vanadate, and sometimes chromate of sodium, and, if much iron is present, in no small degree from the reduction of ferric chloride to ferrous by the platinum of the dish. This last reaction is little known, apparently, but is mentioned in Gmelin-Kraut,[1] and can be readily demonstrated by evaporation of ferric chloride in platinum.

The removal of this platinum before precipitating alumina and iron is not necessary (but see second footnote, p. 57), and to do so involves the reoxidation of all iron and subsequent boiling to remove or destroy the excess of oxidizing agent, together with the expenditure of much valuable time. The iron is already oxidized by the fusion, and needs no further help in that direction. Nevertheless, if time is not a prime object, its removal by hydrogen sulphide is to be recommended. In the following descriptions, however, it is assumed that the platinum has not been gotten rid of at this stage.

VII. METALS PRECIPITABLE BY HYDROGEN SULPHIDE.

The presence in appreciable amounts of metals precipitable by hydrogen sulphide, except perhaps copper, is of such infrequent occurrence in most rocks that discussion is unnecessary in their connection. In case it is necessary to precipitate them at this stage, however, it is always well to bear in mind that a little titanium may be thrown down along with them. Separations of the silica should be made in porcelain, to eliminate platinum, or, better still, the quantitative estimation of these metals should be made in a separate portion of the rock broken up by the action of hydrofluoric and sulphuric acids.

VIII. ALUMINUM. TOTAL IRON.

INDIRECT METHOD FOR ALUMINUM.

The common practice in this laboratory is to find alumina by difference, after deducting from the precipitate produced by ammonia or sodium acetate the sum of all other oxides this precipitate may contain. Of these, only ferric oxide, titanic oxide, and the trace of silica are determined in this portion (see also second footnote, p. 57), those of phosphorus, vanadium, chromium, and zirconium being looked for in other portions of the rock powder. This throws upon the alumina all errors involved in their separate determinations; but these may balance, and in any case the probable error can hardly be as high as that involved in the direct weighing of the alumina itself, considering the difficulty of effecting a satisfactory separation of it from all the other admixtures, an operation which would, moreover, immoderately extend the time required for each analysis.

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[1] Anorg. Chem., Vol. III, p. 359. Sixth revised edition.

PRECIPITATION OF ALUMINUM, IRON, ETC.

Precipitation by ammonia.—Two precipitations by ammonia at boiling heat are usually quite sufficient to separate iron, aluminum, phosphorus, vanadium, chromium, titanium, and zirconium, if all these are present, from nickel, manganese, the alkaline-earth metals, and magnesium, provided ammoniacal salts are present in sufficient quantity. This last point is of special importance as regards magnesium, and failure to observe it is doubtless the reason why many old analyses, and sometimes modern ones, show utterly improbable percentages of alumina, especially as chemists were formerly often satisfied with a single precipitation. The necessary ammonium chloride is better obtained by the use of purified ammonia water and hydrochloric acid than by the addition of the solid salt, which is seldom pure.

Precipitation by the basic acetate method.—But it will occasionally happen that the separation from even very small amounts of manganese is altogether incomplete, and the uncertainty of insuring this separation has led the writer of late to employ the basic acetate method for the first precipitation in all cases where manganese is present—and the exceptions are few—even though the precipitation of alumina is sometimes less complete than by ammonia, and in spite of other admitted defects, as, for instance, a tendency of the precipitate to run through the filter on washing.[1] Not more than 2, or at most 3, grams of sodium acetate need be used. After slight washing and sucking dry at the pump, the precipitate is redissolved in a large excess of hydrochloric acid and reprecipitated by ammonia in slight excess. The complete boiling off of this excess is unnecessary, as pointed out by Genth and Penfield, since it is apparently the washing with pure water and not the free ammonia which carries small amounts of alumina into the filtrate. Penfield and Harper[2] recommend washing with a dilute solution of ammonium nitrate (20 cm.^{3} nitric acid, neutralized by ammonia, to the liter), and also the solution of the first precipitate in nitric instead of hydrochloric acid, in order to shorten the washing, there being no chloride to remove.

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[1] The fact must not be overlooked that certain of the rare earths may pass completely into the filtrate if the basic acetate method is followed. If then, later, on rendering the combined filtrates ammoniacal, an unexpectedly large precipitate appears, this should be carefully examined as to its nature. In an analysis of piedmontite from Maryland over 2 per cent of rare earths, including cerium and others not identified, were quantitatively separated in this way from iron, alumina, etc.

[2] Am. Jour. Sci., 3d series, Vol. XXXII, p. 112, 1886.

The filtrates are strongly concentrated separately[1] in platinum, a drop or two of ammonia being added toward the end to the second one, and filtered successively through the same small filter into a flask of 150 to 200 cm.³ capacity, the ammoniacal filtrate serving as wash water for the first dish and containing enough ammoniacal salt to prevent precipitation of magnesium in the first filtrate when mixed with it. If manganese has been deposited upon the surface of the dish it is removed by hydrochloric and a drop or two of sulphurous acids, which mixture is then passed hot through the filter. A reprecipitation by ammonia is then made, and the precipitate collected again on the filter and added to the main one, the filtrate passing into the flask containing the previous one. If much manganese is present, of course a second precipitation by ammonia of the small precipitate may be required. In these cases there is no difficulty in getting all the manganese into the filtrate.

IGNITION OF THE PRECIPITATE.

The combined precipitates of alumina, etc., are ignited moist, in the paper, unless considerable iron is present, when the main one is dried, removed as far as possible from the paper, and the latter ignited separately to prevent partial reduction of a portion of the iron, which can not then be wholly reoxidized by heating or by treatment with nitric acid (see p. 38).

Alumina in the quantities ordinarily found can not be fully dehydrated by the full heat of the Bunsen burner. It must be blasted for five to ten minutes. If iron is present in large amount this last operation must be conducted so as to insure free access of air to the crucible (p. 51).

RECOVERY OF SILICA AND POSSIBLE BARIUM IN THE ALUMINA PRECIPITATE.

The precipitate is dissolved by fusion with acid potassium sulphate, an operation which is accomplished without trouble in from two to four hours if the temperature is kept low and the acid salt has been properly made free from water and excess of acid. The melt is taken up with hot water and considerable dilute sulphuric acid, the residue collected, weighed, and corrected by hydrofluoric and sulphuric acids for silica,[2] which, as said before, rarely amounts to 1 milligram in weight, and further examined for barium (see p. 53) by dissolving any remaining residue in hot, strong sulphuric acid and diluting with cold water.[1]

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[1] If, instead of sodium acetate, ammonia alone has been used to precipitate alumina, etc., it has sometimes happened in the experience of others than the writer that on concentration of the first filtrate a pale straw-colored precipitate appeared, which remained on the filter with the traces of alumina that may also separate, although it is slowly soluble in hot water. This is said to be some compound of platinum, and attention is called to it here for the guidance of others who may notice it and be unaware of its character.

[2] See inserted page, third paragraph, facing page 53.

ESTIMATION OF IRON IN THE PRECIPITATE OF ALUMINA, ETC.

Without regard to the presence of vanadium.—The filtrate obtained in the preceding paragraph is reduced, hot, by hydrogen sulphide, boiled to collect sulphur and the platinum sulphide[2] resulting from the bisulphate fusion, the hydrogen sulphide being allowed to pass for a short time after boiling. It is then filtered[3] hot into a flask attached to a carbonic-acid apparatus and brought to boiling to expel hydrogen sulphide. When this is fully effected, the flask is cooled in water while the carbon dioxide still passes, and the solution is then titrated by potassium permanganate. The results are strictly accurate, with the limitations set forth in the paragraph below, when care is taken with the reduction by hydrogen sulphide. The method is altogether superior to that involving the use of zinc, since no foreign impurity affecting the result is introduced and the ever-present titanium is not affected, nor is vanadium reduced below the condition of V_2O_4, whereas nascent hydrogen converts it, in part at least, to V_2O_3. Titanium can be conveniently estimated by adding hydrogen peroxide to the titrated iron solution (see p. 68).

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[1] Some years ago, in a series of analyses of rocks from the Leucite Hills, in Wyoming, there was obtained at this stage, when it was customary to dissolve the melt in cold water preliminary to precipitation of titanium by boiling the neutralized sulphuric solution in presence of sulphur dioxide, a white, more or less flocculent residue amounting to 1 to 3 per cent of the rock, which was at first taken to be a mixture of tantalic and columbic acids. Eventually it was found to consist apparently of nothing but TiO_2 and P_2O_5, with perhaps a little ZrO_2. By repeated fusion with acid potassium sulphate and leaching with cold water it could be gradually brought into solution. It was these rocks which furnished the most striking instance of the peculiar, milky, sulphate residues mentioned on p. 53, as derived from the ignited silica.

Knop (Zeitschr. für Kryst., Vol. X, p. 73, 1885) seems to have obtained a similar mixture in analyzing minerals from the Kaiserstuhl in Baden, but its nature was not ascertained, though suspected to be, if not silica, columbiferous titanic acid.

[2] It may be mentioned that the precipitation of platinum from a hot sulphate solution is far quicker and cleaner than from hydrochloric acid. Further, this platinum sulphide, when ignited in the crucible in which the bisulphate fusion was made, should weigh together with the crucible itself what the latter weighed before the main silica precipitate was ignited in it; in other words, the weight of the platinum recovered by hydrogen sulphide should equal the loss in weight of the crucible due to attack by the bisulphate. In somewhat rare instances this will not be so, but the weight will be greater, showing a gain in platinum which may amount to a milligram. Tests have shown that this is not due to retention of platinum by the main Al_2O_3, etc., precipitate; hence it must come from platinum mechanically loosened from the dish during the drying and powdering of the silica preparatory to its collection on the filter, or to some insoluble compound of platinum formed during evaporation and drying of the silica. It may also be in part or wholly due to contamination from reduction of platinum during evaporation of the filtrate from the basic acetate separation. It will be remembered that from this filtrate a small amount of iron and alumina is recovered and added to the main precipitate. Hence it is always well in fine work to collect the sulphide and weigh the platinum in the original crucible, deducting any excess from the alumina, or else to get rid of the platinum by hydrogen sulphide before proceeding to the precipitation of alumina, etc. (see p. 54).

[3] Filtration is not necessary if only precipitated sulphur and no sulphides are in suspension, since this is without reducing action on cold permanganate solution, as Wells and Mitchell, and others before them, have pointed out. The above authors used this method of reducing ferric iron in titanic iron ores. (Jour. Am. Chem. Soc., Vol. XVII, p. 78, 1895; also Chemical News, Vol. LXXIII, p. 123, 1896.)

Having regard to the presence of vanadium.—If vanadium is present, the value found for iron will be in error by the amount of permanganate required to oxidize V_2O_4 to V_2O_5. The amount of the correction will differ according as titration of the iron is made after reduction by hydrogen sulphide or by nascent hydrogen. If the former is used, as should always be the case, because of the ever-present titanium, the vanadium is reduced by it to V_2O_4, which in its action on permanganate is equivalent to two molecules of FeO, while the reduction goes further with hydrogen. After the first transitory pink blush throughout the liquid, the slower-acting vanadium may require the addition of a drop or two more of permanganate before a comparatively permanent coloration appears.

When the amount of vanadium in the rock is known, a correction can be applied on the assumption that practically all the vanadium is here collected, a point that needs further investigation. Various authors assert its precipitability with alumina and iron by ammonia and ammonium-acetate, though Carnot[1] states that repeated precipitation by ammonia, ammonium carbonate, or ammonium sulphydrate, separates it from iron. The writer's experience with ores very rich in vanadium shows that precipitation along with iron and aluminum is only partial. Ridsdale[2] has determined its precipitability with various metals and gives numerous figures which show an approximation to 90 per cent thus thrown down under the conditions prevailing in analysis of iron slags, the remainder passing into the filtrates and appearing in small part with the lime and to a greater extent with the magnesium phosphate. For all practical purposes it is probably safe to assume that the small amounts of vanadium met with in rocks are wholly in the alumina precipitate.

If the amount of vanadium in the rock is not known and great accuracy is necessary, caution requires the determination of the total iron to be made either in a separate portion or after reprecipitation from the above solution, as follows: Fuse with sodium carbonate, extract with water, bring the insoluble residue into sulphuric solution, reduce and titrate as above directed. But unless a certain precaution is here observed an error greater than that which it is designed to avoid will be committed. Contrary to general belief, the aqueous extract from the sodium-carbonate fusion carries a small but appreciable fraction of a per cent of iron, as the writer has repeatedly found by actual test. This iron is thrown out with the alumina (and silica, if present) by the usual methods of neutralizing the alkaline solution, and can be brought to light when the precipitate thus formed is treated with a fixed caustic alkali, or again fused with sodium carbonate and leached with water.

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[1] Comptes Rendus, Vol. CIV, p. 1803, 1887; Zeitschr. für. anal. Chem., Vol. XXXII, p. 223, 1893.

[2] Jour. Soc. Chem. Industry, Vol. VII, p. 73, 1888.

when it remains wholly or in part undissolved. Hence it is necessary to collect this iron and add it to the main portion before titration.

DETERMINATION OF THE TRUE VALUE FOR FERRIC IRON.

Having in one way or another found the total iron in the rock, it remains to deduct an amount equivalent to the ferrous oxide the rock contains, and a further amount corresponding to the sulphides often present, in order to get what may pass for the true value for ferric iron. That this is often only an approximation appears from the difficulties due to the presence of vanadium and the generally indeterminable effect of sulphides on the ferrous oxide determination. (See pp. 94–96.)

METHODS AIMING AT THE MORE OR LESS DIRECT ESTIMATION OF ALUMINUM.

AFTER FIRST REMOVING IRON AS SULPHIDE.

Should it be desirable for any reason to effect an actual separation of aluminum, this may best be done, up to a certain point, after the bisulphate fusion (p. 56), by removal of the iron[1] by ammonium sulphide in ammonium tartrate solution, evaporation of the filtrate, ignition of the residue with sodium carbonate and nitrate, and extraction with water, whereby titanium and zirconium are left on the filter as sodium salts while chromium and vanadium are carried into the filtrate as chromate and vanadate along with aluminum and phosphorus. The further separation of the two last from the chromium and vanadium is outlined under Phosphorus, p. 79. This is as far as the separation can well be carried, and the Al_2O_3 must still be found by subtracting the P_2O_5 from the combined weights of the Al_2O_3 and P_2O_5. The possibility of loss of some P_2O_5 by volatilization[2] during the bisulphate fusion must be borne in mind here, for if it takes place the final weight of $Al_2O_3 + P_2O_5$ will not contain all the P_2O_5.

Some writers recommend dissolving the ignited alumina, iron oxide, etc., in hydrochloric acid, but when the precipitate has been heated over the blast, as it should be, this is very ineffective.

BY EXTRACTION WITH A FIXED CAUSTIC ALKALI.

A favorite practice in some countries of Europe is to fuse the ignited precipitate containing Al_2O_3, Fe_2O_3, TiO_2, P_2O_5, etc.—or that of the Al_2O_3, TiO_2 P_2O_5, etc., after separation of iron by ammonium sulphide in tartrate solution—with sodium hydroxide in a silver crucible, or to boil the freshly precipitated mixture with a solution of the alkali, on the assumption that the titanium oxide is hereby rendered wholly insoluble and thus separated from the alumina. This, however, is in part an error long since pointed out by Gooch,[1] who showed that pure titanic oxide is markedly soluble under both conditions of treatment. Experiments very recently made by the writer to test the extent of this error brought out the following interesting results:

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[1] This being first reduced to the ferrous condition by hydrogen sulphide in acid solution in order to obviate the possibility of precipitating some titanium, which otherwise is likely to happen. (Cathrein, Zeitschr. für Kryst., Vol. VI, p. 246, 1882, and Vol. VII, p. 250, 1883.)

[2] H. Rose speaks of such loss when volatilizing sulphuric acid in presence of phosphoric acid. (Handb. f. quant. Anal., Finkener edition, Vol. II, p. 575, and elsewhere.)

When 0.045 gram of titanic oxide was fused by itself with sodium hydroxide, the clear aqueous extract of the fusion held 0.0031 TiO_2, or about 7 per cent, determined colorimetrically. When freshly precipitated and boiled with the alkali the solubility was less. When fused with sodium carbonate but an infinitesimal trace was dissolved, which required strong concentration for its detection. When mixed with a large excess of alumina and fused with the caustic alkali, the solubility was still very marked, though less than when alumina was absent. With a large excess of ferric oxide, with or without alumina, no titanium could be detected in the unconcentrated filtrate.

It thus appears that fusion with caustic alkali after first removing iron involves an error in the gravimetric determination of both aluminum and titanium which does not appear if the iron has not been removed.

DIRECT PRECIPITATION OF ALUMINA.

A recent and promising method for the "direct determination of alumina in presence of iron, manganese, calcium, and magnesium" is that of Hess and Campbell,[2] but, as with the methods just considered, it involves finally weighing aluminum and phosphorus together, and the behavior of titanium has not been investigated. For this latter reason the details of the method will not be given. Suffice it to say that precipitation of the aluminum and phosphorus is made by phenylhydrazine, after first neutralizing the (preferably chloride) solution by ammonia and reducing iron by a saturated solution of ammonium bisulphite. Phenylhydrazine "precipitates aluminum from its solutions quantitatively as the hydroxide without a trace of the precipitate being redissolved in excess of the precipitant."

IX. MANGANESE, NICKEL, COBALT, COPPER, ZINC.

Ammonia is added to the flask containing manganese, the earths, etc. (p. 56), and hydrogen sulphide gas is introduced, whereby manganese, nickel, cobalt, copper, zinc, and a small part of the platinum from the dish are precipitated. The flask is set aside, corked, for at least twelve hours, and preferably twenty-four, or even longer; the precipitate, collected and washed on a small filter with water containing ammonium chloride and sulphide, is extracted by hydrogen-sulphide water acidified with one-fifth its volume of hydrochloric acid (sp. gr. 1.11), manganese and zinc, if present, going into solution.

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[1] Proc. Am. Acad. Arts and Sci., Vol. XII, p. 436, 1885; Bull. U. S. Geol. Survey No. 27, pp. 16 and 17.

[2] Jour. Am. Chem. Soc., Vol. XXI, p. 776, 1899; Chemical News, Vol. LXXXI, p. 158, 1900.

MANGANESE AND ZINC.

The filtrate is evaporated to dryness, ammonium salts are destroyed by evaporation with a few drops of sodium-carbonate solution, hydrochloric and a drop of sulphurous acids are added to decompose excess of carbonate and to dissolve precipitated manganese, and the latter is reprecipitated at boiling heat by sodium carbonate after evaporation of the hydrochloric acid. If zinc is present, it can be separated from the manganese after weighing. For the small quantities of manganese usually found the sodium-carbonate method of precipitation is to be preferred to that by bromine or sodium phosphate, as equally accurate and a great timesaver.

The precipitation of manganese in alkaline solution by hydrogen peroxide, as proposed by Jannasch and Cloedt,[1] a method which appeared to be simple and accurate, besides affording a separation from zinc, has been shown by Friedheim and Brühl[2] to be valueless, as also other separation methods of Jannasch based on the use of hydrogen peroxide.

The employment of ammonium sulphide instead of bromine for the separation of manganese from the alkaline earths and magnesia has the advantage that, by a single operation, nickel, copper, and zinc are likewise removed if present. There need be no fear of overlooking nickel or copper, for under the conditions of the precipitation they are not held in solution. Now and then a trace of alumina may be found in the precipitate, and magnesia, too, would contaminate it if ammonium salts were not present in sufficient quantity. Regard must therefore be had to these possibilities, and also to the rather remote possibility of the presence of rare earths which were not thrown out by the basic acetate precipitation. (See footnote, p. 55.)

NICKEL, COBALT, COPPER.

The paper containing these is incinerated in porcelain, dissolved in a few drops of aqua regia, evaporated with hydrochloric acid, the copper and platinum thrown out warm by hydrogen sulphide, and nickel and cobalt thrown down from the ammoniacal filtrate by hydrogen sulphide. This is then rendered faintly acid by acetic acid and allowed to stand. The sulphide of nickel is simply burned and weighed as oxide, its weight being always very small, and is then tested for cobalt in the borax bead.

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[1] Zeitschr. für anorg. Chemie Vol. X, p. 405, 1895.

[2] Zeitschr. für anal. Chemie, Vol. XXXVIII, p. 681, 1899.

It is somewhat unsafe to consider traces of copper found at this stage to belong to the rock if the evaporations have been conducted, as is usually the case, on a copper water bath, or if water has been used which has been boiled in a copper kettle, even if tinned inside. Therefore, and because of its contamination by a little platinum, it is better to determine copper in a separate portion if its presence is indicated with certainty. (See p. 54.)

X. CALCIUM AND STRONTIUM (BARIUM).

SEPARATION FROM MAGNESIUM.

Precipitation and ignition of the oxalates together.—The platinum derived from the dish in the silica evaporation, except for the small portion precipitated with the manganese sulphide, is now wholly in the filtrate from the latter. Its separation at this or any other stage is quite unnecessary; nor is the removal of ammonium chloride usually demanded, since there is no undue amount present in most cases, the first precipitation of alumina, etc., having been by sodium acetate.[1] Therefore, without destroying ammonium sulphide the calcium and strontium are thrown out by ammonium oxalate at boiling heat; the precipitate, often darkened by deposited platinum sulphide, is ignited and redissolved in hydrochloric acid, boiled with ammonia to throw out traces of alumina sometimes present and reprecipitated as before, but in a small bulk of solution. It is weighed as oxide, transferred to a small flask of 20 cm.^{3} capacity, dissolved in nitric acid, evaporated to dryness at 150° to 160° C., and the separation of strontium from calcium effected by ether-alcohol[2] as described below.

The weight of strontia found deducted from that of the two oxides gives that of the lime.

Necessity for two precipitations by ammonium oxalate.—It may be said with regard to the separation of calcium from magnesium that two precipitations by ammonium oxalate are essential to the attainment of correct results, not only for the complete removal of magnesium but of sodium as well, the retention of compounds of the latter element by calcium oxalate being now generally known. For the treatment of the filtrates, see Magnesium, p. 64.

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[1] If two or three precipitations by ammonia alone are depended on, the second and third filtrates are evaporated rapidly to dryness and the ammonium salts removed by ignition.

[2] See Fresenius: Zeitschr. für anal. Chemie, Vol. XXXII, pp. 189, 312, 1893, for the latest improvements in this method.

SEPARATION OF STRONTIUM (BARIUM) FROM CALCIUM BY ETHER-ALCOHOL.

The thoroughly dried nitrates are treated with as little (rarely over 2 cm.^{3}) of a mixture in equal parts of absolute alcohol and ether as may be needed to dissolve the calcium salt, solution being hastened by occasional gentle agitation. After standing over night in a corked flask the insoluble matter is collected on the smallest possible filter and washed with more of the above mixture of alcohol and ether. After drying, a few cubic centimeters of hot water are passed through the filter, on which may remain a few tenths of a milligram of residue, which does not usually contain any lime or other alkaline earth, and whose weight is therefore to be deducted from that of the lime, unless it can be shown that it is derived from the glass of the little flask in which the nitrates of calcium and strontium were evaporated. To the solution of strontium nitrate in a small beaker sulphuric acid and then alcohol is added, whereby the strontium is precipitated as sulphate, in which form it is weighed and then tested spectroscopically as to freedom from calcium and barium.

Because of the slight solubility of strontium nitrate in amyl alcohol the method of Browning[1] does not appear to be adapted to the separation from calcium of the small amounts of strontium met with in rocks, though with barium the case is different, since its nitrate according to Browning is insoluble in absolute amyl alcohol.

BEHAVIOR OF BARIUM.

Barium will, after two ammonium oxalate precipitations, never be found with the ignited calcium and strontium in more than spectroscopic traces, unless originally present in excess of 3 or 4 milligrams, and very often only when in considerable excess.[2] If present with them, however, it will be separated with the strontium by ether-alcohol or amyl alcohol, and these two must then be treated by the ammonium-chromate method, given below, in order to arrive at the strontium. The barium is best estimated in a separate portion. (See Barium, p. 73.)

SEPARATION OF BARIUM FROM STRONTIUM.

Fresenius has shown[3] in what manner only a correct separation of barium and strontium can be made by the ammonium-chromate method, involving double precipitation when the amounts are at all large. This procedure is here given for the amounts used by him, but a single precipitation will suffice for the small amounts met with in rock analysis.

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[1] Am. Jour. Sci., 3d series, Vol. XLIII, pp. 50, 314, 1892.

[2] W. F. Hillebrand: Jour. Am. Chem. Soc., Vol. XVI, p. 83, 1894, Chemical News, Vol. LXIX, p. 147, 1894.

[3] Zeitschr. für anal. Chemie, Vol. XXIX, p. 428, 1890.

The volumes of solutions used should be largely reduced and the operations otherwise shortened.

The chlorides corresponding to 0.2774 gram BaO and 0.4864 gram SrO were dissolved in 300 cm.^{3} of water with addition of 6 drops of acetic acid (1.065 sp. gr.). To the hot solution was added an excess (10 cm.^{3}) of ammonium chromate solution (1 cm.^{3} = 0.1 gr. neutral chromate). After settling and cooling for an hour the precipitate was washed, mainly by decantation, with water holding ammonium chromate till the filtrate gave no precipitate with ammonia and ammonium carbonate (100 cm.^{3} used). The washing was continued with warm water till silver nitrate gave but a very slight reddish coloration (110 cm.^{3}). The precipitate was then washed into the precipitating dish, the filter rinsed with warm dilute nitric acid (1.2 sp. gr.), and more nitric acid (2 cm.^{3} in all) added to the dish. The solution having been diluted to 200 cm.^{3} and heated, 5 cm.^{3} of ammonium acetate solution (1 cm.^{3}=0.31 gr. ammonium acetate) was very gradually added, and then ammonium chromate till the odor of acetic acid had wholly disappeared (10 cm.^{3}). After one hour the supernatant liquid was passed through the filter and the precipitate digested with hot water, which was then cooled; thereupon the precipitate itself was brought on the filter and washed with cold water till silver nitrate gave a scarcely perceptible reaction. The strontium was thrown down from the filtrate by ammonia and ammonium carbonate, after concentration in presence of a little nitric acid, and weighed as carbonate; or the carbonate can be redissolved, precipitated by sulphuric acid and alcohol, and weighed as sulphate. The barium is weighed as chromate after ignition, the filter being burned separately.

XI. MAGNESIUM.

PRECIPITATION.

The first precipitation of magnesium is made without special precautions in the filtrate from the first calcium oxalate separation (p. 62) by sodium-ammonium-hydrogen phosphate (microcosmic salt)[1] in indefinite decided excess and without the great excess of ammonia usually prescribed. It is not necessary to first remove ammoniacal salts unless very little magnesium is present, and then only in order to hasten precipitation. Neubauer[2] has shown that precipitation is complete even in presence of large quantities of salts of ammonium, including the oxalate. He has, however, also shown that the composition of the precipitate is largely affected by ammonium salts, and also by the way in which the precipitation is made. These points are of importance only when a single precipitation is to be made or in the final of two or more, as will be discussed later.

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[1] The objection that has been made by one writer to the use of this salt instead of disodium-hydrogen phosphate is, so far as our experience teaches, entirely groundless.

[2] Zeitschr. für angew. Chemie, 1896, p. 435.

Platinum sulphide usually strongly contaminates the separated phosphate, but this matters not, as it remains on the filter when the phosphate is redissolved in hydrochloric acid, of which not more than the amount really needed should be used. The solution thus obtained is united with that of the residue from evaporation and ignition of the second filtrate from calcium oxalate, and is diluted if necessary. A few drops of sodium-ammonium phosphate solution are now added, and ammonia in slight excess, with constant stirring till the crystalline precipitate has well formed. The large excess of ammonia of 0.96 specific gravity (one-third the original volume) usually prescribed has been shown by Gooch and Austin[1] to be quite unnecessary, in fact, disadvantageous.

Neubauer in the above-cited paper has shown, and Gooch and Austin (loc. cit.) have confirmed his statements, that it is only by working under these conditions—absence of any large excess of precipitant, of ammoniacal salts, and of ammonia—that a precipitate of normal composition is obtainable. It usually differs from the normal in containing relatively more ammonium and less magnesium—for instance, an admixture of such a molecule as $Mg(NH_4)_4(PO_4)_2$—the result being that when ignited in the ordinary way too much magnesium is found, because of formation of some metaphosphate. To obviate this error Neubauer considers it absolutely necessary to blast the precipitate for half an hour, and then to repeat the blasting for a second half hour to see if a constant weight has been reached. The phosphate is then entirely pyrophosphate, which is quite unaffected by further blasting. The intense heat has caused a decomposition of the metaphosphate with volatilization of P_2O_5, as follows: $2\ Mg(PO_3)_2 = Mg_2P_2O_7 + P_2O_5$. Neubauer worked with the usual excess of ammonia, and it remains to be seen whether by precipitating and working according to Gooch and Austin the composition of the precipitate is always close enough to the ideal $MgNH_4PO_4$ to obviate the necessity for blasting.

From the labors of Neubauer and of Gooch and Austin it is clear that the common way of adding the phosphate precipitant to the ammoniacal solution of the magnesium salt is not calculated to produce a precipitate of normal composition. The precipitant should be added to the acid solution of the magnesium, and ammonia should then be added in slight excess.

Gooch and Austin call attention to a modification proposed some years ago by Wolcott Gibbs,[2] whereby the phosphorus and magnesium salts are first boiled together in neutral solution for a few minutes and to the cooled solution ammonia is added. The results are said to be remarkably exact.

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[1] Am. Jour. Sci., 4th series, Vol. VII, p. 187, 1899; Chemical News, Vol. LXXIX, pp. 233, 244, 255, 1899; Zeitschr. für anorg. Chemie, Vol. XX, p. 121, 1899.

[2] Am. Jour. Sci., 3d series, Vol. V, p. 114, 1873.

METHODS OF COLLECTING AND IGNITING THE PRECIPITATE.

If the blast has not to be employed, the weight of the pyrophosphate can doubtless be most accurately arrived at by collecting and igniting the precipitate in a Gooch crucible, provided the asbestos felt is well constructed and not of the serpentine variety so largely on the market.

Neubauer ignites slowly in platinum after drying, without removing from the paper, applying the blast only when the carbon has been wholly burned off.[1]

Almost as exact are the two modifications of the method in use for phosphate analyses at the agricultural experiment stations at Danzig and Lisbon, described by Schmoeger[2] and Mastbaum.[3] According to the former the precipitate after drying is detached from the paper and placed in a platinum crucible, followed by the folded filter. To the covered crucible the full flame of a burner is applied, and after a short time the burning off of the carbon is accomplished with the crucible open. A short blasting follows. In a number of experiments on quantities ranging from 0.06 to 0.28 gram of pyrophosphate the results were, with a few exceptions, naturally lower than those obtained on duplicates by the ordinary method of igniting, but only by 0.0013 gram in maximum.

Mastbaum, to shorten time, applies the full flame to the moist precipitate wrapped in its filter. Later, when most of the carbon is burned off, he moistens the residue with two or three drops of strong nitric acid, evaporates this carefully, heats with full burner for a few minutes, then blasts for half a minute. He describes the results as irreproachable. In this laboratory only the Mastbaum modification has been tried, and it certainly seems to be satisfactory when the extreme of accuracy is not required.

At one time the procedure first recommended by Ulbricht, later by Broockmann, and also by L. L. de Koninck, was used. It consists in dissolving the ammonium-magnesium phosphate off the filter with nitric acid, collecting the filtrate in a weighed crucible, evaporating the contents to dryness,[4] and subsequently igniting, the product being presumably pyrophospate. But it was soon observed that the ignited salt, especially when large in amount, does not always dissolve com-

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[1] Zeitschr. für anal. Chemie, Vol. XXXIII, p. 362, 1894; Jour. Am. Chem. Soc., Vol. XVI, p. 289, 1894.

[2] Ibid., Vol. XXXVII, p. 308, 1898.

[3] Ibid., p. 581, 1898.

[4] A pink color of varying intensity almost invariably becomes apparent as the mass approaches dryness, a most delicate test for the traces of manganese which always escape precipitation by ammonium sulphide or bromine.

[Insert for Bulletin No. 176 (reprint), U.S. Geol. Survey; to face page 66.]

(June, 1902.)

ADDITIONAL NOTES ON THE IGNITION OF MAGNESIUM PYROPHOSPHATE.

Since the first issue of this Bulletin the experience of the chemists of the Survey has been decidedly adverse to the blasting of magnesium pyrophosphate, as prescribed by Neubauer, whether obtained by precipitation of magnesium or of phosphate solutions. If the weights are not very large, the salt fuses in part or wholly, and when this occurs reduction seems to be rapid, and the crucible is strongly attacked, as shown by its loss of weight after dissolving out the pyrophosphate. Presumably this effect is caused by a blast of higher temperature than that employed by Neubauer, who is very emphatic in his assertion that neither pure pyrophosphate nor crucible experiences the slightest loss when blasted for hours. Results similar to ours are reported by other chemists who have employed the blast; so that, whatever the cause of the unsatisfactory results, it is plain that, until a sure remedy is worked out, it is far preferable to endeavor to secure a phosphate of normal composition at the start than to effect this later by blasting.

What effect the presence of slight amounts of foreign phosphates may have in increasing the fusibility of magnesium pyrophosphate is unknown. The fact may here be emphasized that the phosphate precipitate obtained in the determination of magnesia in the ordinary course of mineral analysis is never quite pure. Traces of lime, manganese, iron, and alumina, one or all, are invariably present and their complete removal is extremely difficult. Personally, the writer has never found the precipitate to be contaminated by silica.

pletely in hydrochloric acid, but that sometimes a white residue is left in light lumps which appears to be quite insoluble in acids. This residue contains no silica, but only the constituents of a magnesian phosphate, and it may be a peculiar metaphosphate. Whether its appearance is due to an abnormal composition of the original magnesian precipitate or to conceivable change during evaporation in the crucible with nitric acid remains to be determined. Until this is done the employment of this method of igniting is not to be recommended.

CONTAMINATION BY AND REMOVAL OF BARIUM AND CALCIUM.

Barium phosphate will not contaminate the second magnesian precipitate unless there are notable amounts of barium in the rock, in which case it must be removed by sulphuric acid prior to the final precipitation of the magnesium. Calcium, however, is probably never absent, and has to be estimated and allowed for as follows:

To the ignited pyrophosphate, dissolved in but slight excess of hydrochloric acid, is added ammonia to alkalinity, and then acetic acid, drop by drop, till the solution, which should not be hot, clears. It now and then happens that a little flocculent matter fails to dissolve. This is to be removed, ignited, and subtracted from the original weight. It is likely to consist, in great part or wholly, of phosphates of iron or manganese, or both, and shows often a reddish color on ignition. If an excess of acetic acid has been used, this is cautiously removed by ammonia. Then a drop or two of solution of ammonium oxalate is added, and the small beaker is set aside for twelve hours if necessary. Almost invariably a small precipitate soon shows itself, which if fine-grained and nonadherent to the glass may be regarded as pure calcium oxalate; otherwise it contains, or may largely consist of, magnesium oxalate. It is in that case to be collected, ignited, redissolved, and reprecipitated. Its final weight, averaging perhaps one-half milligram, is to be added to that of the lime already found, and subtracted as tricalcium phosphate from that of the magnesium pyrophosphate in order to arrive at the true figure for magnesia. This separation, to be satisfactory, requires great care.

XII. TITANIUM.

COLORIMETRIC ESTIMATION WITH HYDROGEN PEROXIDE (WELLER'S METHOD).[1]

The method consists in comparing the color of a known bulk of solution to be tested with that of a standard solution of titanium sulphate, both having been fully oxidized by hydrogen peroxide. The strength of the peroxide should be approximately measured by titration with permanganate on opening a fresh bottle, and again after a few weeks, otherwise very serious error may arise through its deterioration.

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[1] Ber. deutsch. chem. Gesell., Vol. XV, p. 2593, 1882.

Mere traces of hydrofluoric acid, either in the peroxide or the titanium solution, render this method inexact,[1] hence care should be exercised as to the character of the peroxide, which, as sold in the market, often contains fluorine.

Dunnington[2] has pointed out the necessity for the presence of at least 5 per cent of sulphuric acid in solutions which are to be thus tested for titanium, in order, as he concludes, to prevent partial reversion to metatitanic acid, which does not give a color with hydrogen peroxide. The standard solution of titanium sulphate, holding conveniently about 1 centigram TiO_2 in 10 cm.^{3}, equivalent to 1 per cent of TiO_2 in 1 gram of rock, contains, therefore, 5 per cent or more of sulphuric acid. Of this, 10 cm.^{3} are mixed with a sufficiency of hydrogen peroxide (2 cm.^{3} of most commercial brands is ample) and diluted to 100 cm.^{3} in a measuring flask.

Titanium can be estimated, as a rule, most conveniently in the solution which has served for the titration of total iron (p. 57). This, having been evaporated, if necessary, to less than 100 cm.^{3}, is to be fully oxidized with hydrogen peroxide, and if the color is less intense than that of the standard, is made up to 100 cm.^{3} with dilute sulphuric acid in a measuring flask, and mixed; otherwise, in a flask of sufficient size to insure that its color shall be less intense. One of the rectangular glasses described below being filled with the solution to be tested, 10 cm.^{3} of the diluted standard are run into the other from a burette, and water is added from a second burette until there is no distinction as to color. A second and a third portion of the standard can be run in and diluted and the mean of several determinations struck, when a simple calculation gives the percentage of TiO_2 in the rock.

If the convenient but expensive Soleil-Duboscq colorimeter is used, or the simple Nessler tubes, it is of course unnecessary to dilute the rock solution to the extent above required, should it be stronger than the standard. Experience has shown, however, that differences can not be sharply estimated in strongly colored solutions, and that the results are much more satisfactory when the color intensity is not much, if any, greater than that given by a standard of the above concentration. For the percentages of titanium found in rocks, clays, and soils, usually under 1 per cent, but rising to 2 or even 3 per cent or more occasionally, the colorimeter method gives results which are fully equal to those of the best gravimetric method, besides being a great time saver. The error introduced by iron, in consequence of the yellowish color of its sulphate solution, is practically negligible unless its percentage is very high; then either the iron must be removed prior to making the color test, or correction should be applied for known amounts of ferric sulphate in solutions of the requisite dilution.

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[1] Hillebrand: Jour. Am. Chem. Soc., Vol. XVII, p. 718, 1895; Chemical News, Vol. LXXII, p. 158, 1895. Bull. U. S. Geol. Survey No. 167, p. 56.

[2] Jour. Am. Chem. Soc., Vol. XIII, p, 210, 1891.

The exact correction to be applied in such cases is difficult of determination because of the impossibility of matching the colors of titanium peroxide solutions with those of ferric sulphate; but tests made go to show that the coloring effect of 0.1 gram of Fe_2O_3 in 100 cm.^{3} 5 per cent sulphuric-acid solution is about equal to 0.2 milligram of TiO_2 in 100 cm.^{3} when oxidized by hydrogen peroxide. This amounts to a correction of only 0.02 per cent on 1 gram of rock containing the unusual amount of 10 per cent Fe_2O_3. It will be more satisfactory, when much iron is present, to remove this as described on page 71 and to colorimetrically estimate the titanium thus freed from iron.

ALTERNATIVE MODE OF PREPARING THE TEST SOLUTION.

As said above (pp. 57 and 68), the solution that has been used for volumetric estimation of total iron can most conveniently be used for the colorimetric determination of titanium, but if desired this can, of course, be made on some other portion of rock powder. At one time it was the practice in this laboratory to combine it with the determination of barium, as described in Bulletin 148 of the United States Geological Survey, by decomposing the powder by sulphuric and hydrofluoric acids,[1] expelling the latter by repeated evaporations with sulphuric acid, taking up with dilute sulphuric acid,[2] filtering from barium sulphate, etc., and estimating the titanium colorimetrically in the filtrate. The expulsion of fluorine must be thorough, or else the titanium result will be low, as already stated (p. 68), and it is not always easy to effect this complete removal, though the time required to do so seems to be in no slight degree dependent on the nature of the fluorides to be decomposed. Long after every trace of fluorine seems to be gone, the formation of a crust on the evaporating solution sometimes allows an accumulation of enough hydrofluoric-acid gas to become plainly manifest to the smell on breaking the crust.

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[1] It is to be borne in mind that evaporation with hydrofluoric acid alone results in loss of titanium by volatilization, but that there is no loss if excess of sulphuric acid is also present.

[2] With acid rocks solution is very complete, and it can be made nearly so with the most basic by transference to a small beaker and gentle boiling. The residue thus obtained may contain, besides barium sulphate, a little calcium sulphate, zircon, andalusite, topaz, and possibly a trace of titanium in some form. It is therefore to be thoroughly fused with sodium carbonate, leached with water, fused with potassium bisulphate, dissolved in dilute sulphuric acid, filtered, and the filtrate added to the main one. The insoluble matter will now be chiefly barium sulphate, for the further treatment of which see page 74.

THE COLORIMETRIC APPARATUS AND ITS USE.

The glasses G (fig. 12) may be of square or rectangular section, 8 to 12 cm. high and 3 to 3½ cm. inside measurement between those sides through which the liquid is to be observed.[1] These sides should, of course, be exactly parallel; the others need not be, but should be blackened externally. In order to further exclude the effect of side light in this and other similar methods (chromium, for instance, p. 80), it is very convenient to have a simple light box (B, fig. 12) that can be easily held in one hand, about 35 cm. long and 12 cm. square, stained black inside and out and with one end closed by a piece of ground glass. W, the other open. For a space equal to the width of the glasses the

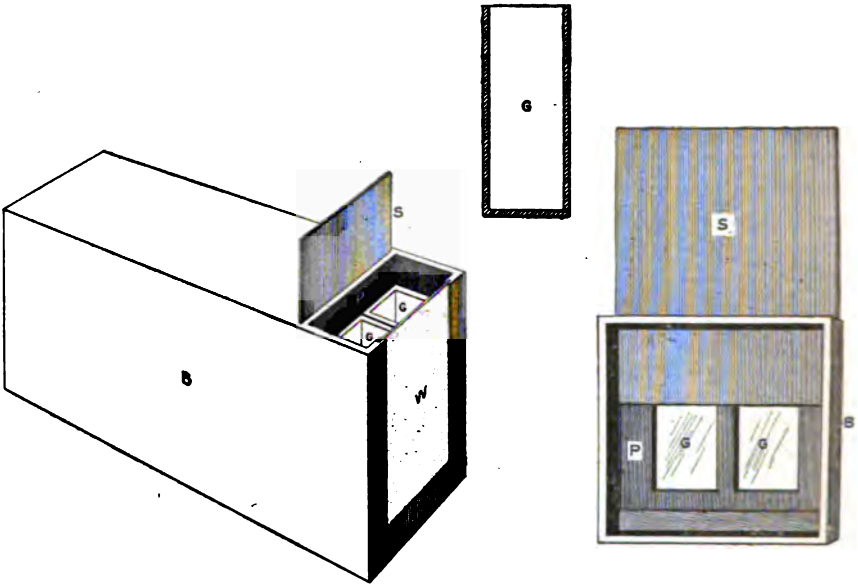

FIG. 12.—Apparatus for colorimetric determinations, in different aspects. G, one of two glasses of square or rectangular section, 8 to 12 cm. high and 3 to 3½ cm. inside measurement between those sides through which the liquid is to be observed. The other sides are blackened on the outside. B, rectangular box about 35 cm. long and 12 cm. square, stained black inside and out, one end closed by a ground-glass window, W, the other open, and a portion of the top removed. P, blackened partition, with openings corresponding to the interior dimensions of the glasses when in position. S, blackened cardboard shutter sliding stiffly up and down between partition and glasses, so as to shut off all light above the lowest surface of the liquid in the glasses.

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[1] The allowable error in distance between the corresponding pairs of sides of the two glasses should not in any case exceed 1 per cent. Unfortunately there seems to be a disinclination or inability on the part of dealers in this country to furnish glasses fulfilling this requirement, and held together by a durable cement which shall be proof against dilute sulphuric acid. Canada balsam answers well for a time, but sooner or later it cracks, leaks then appear, and the sides soon drop off. It is, however, but a simple matter to cement them on again.

A pair of entirely satisfactory glasses can be made from a couple of square or rectangular 3 to 4 ounce bottles by cutting off one pair of sides from each and grinding down till the calipers show that agreement is perfect. The tops are then to be sawed off and pieces of plate glass cemented on the sides.

cover is removed at the top next the glass end to permit of the insertion of the glasses side by side in such a way that no light shall penetrate around their sides or between them. Immediately back of the glasses is a partition P, with openings of appropriate size cut in it. A stiffly sliding black cardboard shutter S is movable up and down immediately back of the partition, so that all light can be cut off except that which comes through the liquid.

Precautions of this kind are necessary if accurate results are to be counted on. Except for mere traces, this combination of glasses and darkened box insures greater accuracy and rapidity of work than Nessler tubes, and is preferable likewise, so far as the writer's experience goes, to expensive instruments like the colorimeter of Soleil-Duboscq, etc. In making the color comparisons the box is best held close to a window, so as to get a full, strong light. Daylight is far preferable to artificial light.

GOOCH'S GRAVIMETRIC METHOD.

When titanium is present in excess of 4 to 5 per cent and whenever for any reason it is desired to employ a gravimetric method, among the few that have been thoroughly tested that of Dr. Gooch[1] is unequaled. With one or two minor modifications introduced by Dr. T. M. Chatard,[2] it is as follows:

Any solution of the rock freed from silica can be used, and the first step is to remove the iron. This is best done, after adding tartaric acid and reducing the iron by means of hydrogen sulphide to the ferrous condition, by rendering the solution ammoniacal and introducing more hydrogen sulphide. If the iron is not thus reduced before precipitation, titanium will be in part thrown down also.[3] The amount of tartaric acid is to be gauged according to the combined weights of the oxides to be held by it in solution, and three times this weight is ample. After removing the iron sulphide by filtration—little washing suffices, because of the relatively small amount of titanium commonly present—the tartaric acid is destroyed as follows:

Potassium permanganate to the extent of two and one-half times the weight of the tartaric acid used is made into a strong solution, and to the ammoniacal filtrate from the iron sulphide enough sulphuric acid is introduced to leave some excess after all the permanganate has been reduced. After expulsion of hydrogen sulphide by boiling, the permanganate is added gradually to the hot solution contained in a large beaker or flask. A vigorous reaction ensues. When a permanent brown precipitate of manganic hydrate appears the tartaric acid has been fully broken up, and the precipitated manganese is to be redissolved by a few drops of ammonium bisulphite or of sulphurous acid solution.

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[1] Proc. Am. Acad. Arts Sci., n. s., Vol. XII, p. 435; Bull. U. S. Geol. Survey No. 27, p. 16, 1886, Chemical News, Vol. LII, pp. 55 and 68, 1885.

[2] Am. Chem. Jour., Vol. XIII, p. 106, 1891; Bull. U. S. Geol. Survey No. 78, p. 87, Chemical News, Vol. LXIII, p. 267, 1891.

[3] Cathrein: Zeitschr. für Kryst., Vol. VI, p. 243, 1882; Vol. VII, p. 250, 1883.

Ammonia is then added in slight excess, followed at once by acetic acid in considerable excess, and the boiling is continued for a few minutes. Thereby the titanium is freed from most of the alumina, and from lime and magnesia if they had not been earlier removed, also from most of the manganese introduced. The precipitate is filtered and washed with water containing acetic and sulphurous acids, then ignited, fused thoroughly with sodium carbonate, and leached with water to remove phosphoric acid and most of the remaining alumina. The residue is again ignited and fused with sodium carbonate. To the cooled melt in the crucible strong sulphuric acid is to be added, wherein it dissolves readily by aid of gentle heat. This solution is to be poured into a small volume of cold water and the platinum it contains precipitated by hydrogen sulphide at or near boiling temperature. After filtering and cooling, ammonia is added till the titanium is just precipitated, and a measured volume, containing a known weight of absolute sulphuric acid, is then added—just enough to redissolve the precipitate. The solution is then made up with acetic acid in such amount that the final bulk shall contain from 7 to 11 per cent of absolute acid, and then enough solid sodium acetate is stirred in to more than take up the sulphuric acid introduced. Upon rapidly bringing the liquid to ebullition the titanium is precipitated in flocculent and easily filterable condition, and the precipitation is complete after a minute's boiling, provided all the prescribed conditions have been followed and zirconium is absent.

The precipitate is washed first with acetic acid of 7 per cent strength and then with hot water. After 15 to 20 minutes' ignition over a good burner it is in condition for weighing and will lose no more weight over the blast lamp. For large amounts of titanium a repetition of the sodium carbonate fusion, etc., should be made. The actual carrying out of all these operations, when once the method is understood, requires much less time than the detailed description would indicate.

GOOCH'S METHOD NOT DIRECTLY APPLICABLE TO ROCKS CONTAINING ZIRCONIUM.

Prior to the adoption of the colorimetric method, Dr. Gooch's was invariably used in this laboratory. Occasional inability to secure clean and complete precipitation by it was experienced, especially with a certain series of rocks rather poor in titanium. Long research showed the difficulty to be due to the presence of zirconium, which acts as a marked preventive of the precipitation of titanium by boiling in an acetic acid solution under the conditions of the Gooch method.

The above rocks were found to contain up to 0.2 per cent of ZrO_2, and this amount was able to prevent precipitation of 0.3 per cent of

TiO_2. The titanium which came down in excess of this amount did not settle out in flocculent condition, as happens when zirconium is not present, and it was difficult to filter. After the removal of the zirconium in the manner to be hereafter described (p. 75), however, no difficulty was experienced in precipitating all the titanium with the usual ease.

SUPERIORITY OF THE COLORIMETRIC AND GOOCH METHODS OVER THE OLDER ONES.

In view of the good results obtainable by the colorimeter method in all cases and by the Gooch method in the absence of zirconium, it is incomprehensible that the old method of precipitation by many hours' boiling in a nearly neutral sulphate solution in presence of sulphurous acid should still find adherents in any part of the world.

Attention has been directed (p. 60) to the error resulting from attempting to separate aluminum from titanium by either fused or dissolved sodium hydroxide.

BASKERVILLE'S METHOD.

Baskerville[1] has proposed the separation of titanium from iron and aluminum by boiling the neutralized solution of the chlorides for a few minutes in presence of sulphurous acid. The test separations as given by him are sharp, and a single precipitation is said to suffice, the titanium being free from iron and easily filterable. This last statement and the ready precipitability are fully confirmed by the experiments of the writer on titaniferous iron ores, but, although the titanium is completely thrown out, it carries with it a little iron, for instance, about 0.25 per cent Fe_2O_3 with 8 to 10 per cent TiO_2. Zirconium would probably be likewise precipitated (see p. 77) and phosphorus perhaps also, but this last point has not been investigated; neither has the applicability of the method to aluminous rocks been tested.

XIII. BARIUM (ZIRCONIUM, TOTAL SULPHUR).

Reasons for estimating barium in a separate portion of rock powder.—It has been said above (p. 63) that only in very exceptional cases will barium be found with the calcium and strontium after two, or possibly three, precipitations of the latter as oxalate, since it passes into the filtrates with the magnesium, whence it may be obtained as sulphate after removal of ammoniacal salts. Addition of some alcohol insures also the recovery of traces of strontium if the rocks are very rich in it. But it is unsafe to regard the amount thus separated from the magnesium as representing the total amount of barium in the rock. It will almost always be found too low, probably for the reason that there are opportunities during the analysis for slight losses. It is best to estimate it in a separate 2-gram portion, which may also serve with advantage for the estimation of zirconium and total sulphur.

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[1] Jour. Am. Chem. Soc., Vol. XVI, p. 427, 1894.

Modes of attack and subsequent treatment.—If zirconium and sulphur are not to be looked for, the simplest procedure is to decompose the powder by sulphuric and hydrofluoric acids (see p. 69, under Titanium), and to complete the purification of the barium sulphate thus obtained in the manner described in the third paragraph below.

If zirconium and sulphur are both to be likewise determined, decomposition is effected by fusing over the Bunsen flame and then over the blast with sulphur-free sodium carbonate and insufficient niter to injure the crucible, first fitting the latter snugly into a hole in asbestos board (Lunge) to prevent access of sulphur from the gas flame. In case sulphur is not to be regarded, the niter and asbestos board are omitted. After thorough disintegration of the melt in water, to which a drop or two of methyl or ethyl alcohol has been added for the purpose of reducing manganese, the solution is filtered and the residue washed with a very dilute solution of sodium carbonate free from bicarbonate. This is to prevent turbid washings. A yellow color in the filtrate indicates chromium.

For the further treatment of the filtrate see Sulphur, p. 106, and Chromium (colorimetric method), p. 80.

The residue is dissolved in quite dilute warm sulphuric acid (stronger acid may be used if barium only is sought) and filtered through the original filter. This, with its contents, is ignited, evaporated with hydrofluoric and sulphuric acid, and taken up with hot dilute sulphuric acid. The filtrate, added to the former one, now contains all the zirconium (see pp. 75–76 for its further treatment). The residue contains all the barium, besides some of the strontium, and perhaps a good deal of calcium. It is fused with sodium carbonate, leached with water, the residue dissolved off the filter by a few drops of hydrochloric acid, from which solution the barium is thrown out by a large excess of sulphuric acid. A single solution of the barium sulphate in concentrated sulphuric acid and reprecipitation by water suffices to remove traces of calcium which might contaminate it if the rock was one rich in calcium, and even strontium is seldom retained by it in quantity sufficient to give concern. Should this be the case, however, which will occur when the SrO and BaO are together in the rock in, roughly speaking, 0.2 and 0.4 per cent, respectively, the only satisfactory way is to convert the sulphates into chlorides and to apply to the mixture the ammonium-chromate method of separation (p. 63).

Barium and strontium sulphates can be brought into a condition for testing spectroscopically by reducing for a very few moments the whole or part of the precipitate on a platinum wire in the luminous tip of a Bunsen burner, and then moistening with hydrochloric acid. This should be known to everyone, but probably is not.

The procedure outlined in the foregoing paragraphs for the estimation of calcium, strontium, and barium in silicate rocks is the one which long experience has shown to be best adapted for securing the most satisfactory results with a minimum expenditure of time.[1] Even where no attempt is made to separate contaminating traces of SrO and BaO one from the other, the error is usually of no great consequence, for an absolute error of even 25 per cent in a substance constituting only one or two tenths per cent of a rock is ordinarily of small moment compared with the ability to certify to its presence with approximate correctness.

With such small amounts of barium as are usually found in rocks it is doubtful if Mar's[2] method for the separation of barium from calcium and magnesium, by the solvent action of concentrated hydrochloric acid mixed with 10 per cent of ether on the chlorides, could be conveniently applied here, although for larger amounts the method would seem to be accurate and easily executed. Moreover, it would probably not entirely remove contaminating strontium, and hence offers no advantage.

XIV. ZIRCONIUM.

This element is rarely looked for by chemists, though shown by the microscope to be one of the most constant rock constituents, usually in the form of zircon, in which occurrence its amount can be approximately judged of and a chemical test rendered almost unnecessary; but sometimes it occurs in other minerals, and is then unrecognizable under the microscope. It may rarely be present up to a few tenths of 1 per cent of the rock.

AUTHOR'S METHOD.

For its detection and estimation in such cases, or whenever a search for it seems called for, the following procedure, based on a method by G. H. Bailey,[3] has been devised, which serves, when carried out with care, to detect with certainty the merest trace—0.02 per cent, for instance—in 1 gram.

The preliminary treatment of the rock powder has been fully given under Barium (p. 74), where the separation from barium has been described and also the concentration of the zirconia in a small amount of very dilute sulphuric solution. This should probably not contain much above 1 per cent of sulphuric acid, though the actually permissible limit has not been established. To the solution, which should be in a small flask, is now added hydrogen peroxide to oxidize the titanium, and then a few drops of a soluble orthophosphate solution. The flask is set aside in the cold for twenty-four to forty-eight hours. If the color bleaches after a time, more hydrogen peroxide should be added. Under these circumstances the zirconium is thrown out as phosphate and collects as a flocculent precipitate, which at this stage is not always pure. No matter how small or insignificant, it is collected on a filter, ignited, fused with sodium carbonate, leached with water, the filter again ignited, fused with very little acid potassium sulphate, brought into solution in hot water with a few drops of dilute sulphuric acid, poured into a flask of about 20 cm.^{3} capacity, a few drops of hydrogen peroxide and of sodium phosphate added, and the flask set aside. Titanium is now almost never present, and the zirconium appears after a time as a white flocculent precipitate, which can be collected and weighed as phosphate. For the small amounts usually met with it is safe to assume that it contains 50 per cent of ZrO_2 (51.8 by theory). If the amount is rather large, it may be fused with sodium carbonate, leached, ignited, fused with acid potassium sulphate, reprecipitated by ammonia, and weighed as ZrO_2. Certainty as to its identity can be had by again bringing it into solution, precipitating by ammonia, dissolving in hydrochloric acid, evaporating to a drop or two, and testing with turmeric paper or by a microchemical reaction. With the very smallest amounts no color can be obtained by this turmeric-paper test, which, however, responds readily to as little as 1 milligram of dioxide and with proper care for as small an amount as 0.3 milligram (Dr. H. N. Stokes). No element other than thorium is ever likely to contaminate the zirconium thus precipitated.

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[1] For details consult W. F. Hillebrand: Jour. Am. Chem. Soc., Vol. XVI, p. 83, 1894; Chemical News, Vol. LXIX, p. 147, 1894.

[2] Am. Jour. Sci., 3d series, Vol. XLIII, p. 521, 1892.

[3] Jour. Chem. Soc., Vol. XLIX, pp. 149, 481, 1886.

In Bailey's experiments the precipitation was not made by addition of a phosphate, but is said to be due solely to the hydrogen peroxide, the precipitate being a hydrated peroxide, Zr_2O_5, or ZrO_3.[1] My own efforts to secure a precipitate in acid solutions of zirconium sulphate by hydrogen peroxide alone were unsuccessful, perhaps for lack of a sufficiently strong peroxide. The ability to obtain the zirconium free from phosphoric acid would certainly be a great improvement on the method described above.

Were it not for the necessity of working in a weakly acid solution, the separation of zirconium could be made in the same portion in which the titanium is colorimetrically determined.

OTHER METHODS OF SEPARATING ZIRCONIUM.

Streit and Franz[2] claim to secure complete separation of titanium from iron and zirconium by boiling the neutralized solutions of the sulphates with a large excess (50 per cent) of acetic acid. The method has been from time to time recommended, but without any data showing its value. The single separation made by Streit and Franz was far from perfect.

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[1] Bailey, Chemical News, Vol. LX, p. 6, 1889.

[2] Jour. für prakt. Chemie, Vol. CVIII, p. 65, 1869.

Davis[1] separated zirconium sharply from aluminum, but not from iron, by precipitation as an oxyiodate in a boiling neutralized solution of chlorides, but the method is hardly applicable for rock analysis.

Baskerville[2] has proposed a method for the separation of zirconium from iron and aluminum similar to his method for the separation of titanium from those elements (p. 73). It is based on the precipitability of ZrO_2 by boiling the neutralized chloride solution for two minutes in presence of sulphurous acid, and seems to be excellent. As titanium is always present and is presumably quantitatively thrown down also, the two would have to be separated by hydrogen peroxide. No tests as to the availability of the method for separating the small amounts met with in rock analysis have been made.

XV. RARE EARTHS OTHER THAN ZINCONIA.

For the few cases in which it may be necessary to look for rare earths other than zirconia, the following procedure is suggested as likely to prove satisfactory:

The rock powder is thoroughly decomposed by several partial evaporations with hydrofluoric acid, the fluorides of all earth metals except zirconium are collected on a platinum cone, washed with water acidulated by hydrofluoric acid, and the precipitate washed back into the dish or crucible and evaporated with enough sulphuric acid to expel all fluorine. The filter is burned and added. By careful heating the excess of sulphuric acid is removed and the sulphates are taken up by dilute hydrochloric acid. The rare earths, with perhaps some alumina, are then separated by ammonia, washed, redissolved in hydrochloric acid, and evaporated to dryness, then taken up with water and a drop of hydrochloric acid, and only enough ammonium acetate to neutralize the latter added, followed by oxalic acid (not ammonium oxalate, which would fail to precipitate thorium). In this way as little as 0.03 per cent of rare earth has been found when working on not more than 2 grams of materials.

This method eliminates at once most of the aluminum, all the iron, phosphorus, titanium, and zirconium, and has the further advantage of collecting with the earthy fluorides, as UF_4, any uranous uranium that the rock might have held.

An alternative method would be to fuse with sodium carbonate, leach with water to get rid of phosphorus as far as possible, dissolve the residue in hydrochloric acid, separate silica as usual, precipitate alumina, etc., by ammonia, dissolve the precipitate again in hydrochloric acid, evaporate, and proceed as by the former method, which in most cases would undoubtedly give better results than this one.

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[1] Am. Chem. Jour., Vol XI, p. 27, 1889.

[2] Jour. Am. Chem. Soc., Vol. XVI, p. 475, 1894. Chemical News, Vol. LXX, p. 57, 1894.

XVI. PHOSPHORUS.

It is sometimes possible to extract all phosphorus from a rock by simple digestion with nitric acid, but quite as often, if not oftener, this fails; hence the necessity for resorting to one of the longer methods of extraction detailed below.

PROCEDURE WHEN MATERIAL IS AMPLE.

When material is ample it is best to use one portion for phosphorus only and to proceed as follows:

Fuse with sodium carbonate, separate silica by a single evaporation with nitric acid, treat the ignited silica with hydrofluoric and a drop or two of sulphuric acids, evaporate to expel hydrofluoric acid, bring the small residue into solution by boiling with nitric acid and add it to the main portion, in which, after addition of considerable ammonium nitrate, precipitate the phosphorus by molybdate solution.

The turbidity often observed on dissolving the precipitated and washed phospho-molybdate in ammonia is due to a compound of phosphorus. If the addition of a small fragment of a crystal of citric or tartaric acid fails to dissolve it, this should always be re-fused with sodium carbonate, extracted with water and the filtrate otherwise treated as above, in order to secure the phosphorus in it.

According to Gooch and Austin,[1] in order to secure a magnesium-ammonium phosphate of normal composition, the procedure at this point should be as follows: To the phosphate solution, containing not more than 5 to 10 per cent of ammonium chloride and a slight excess of magnesia mixture, a little ammonia is added, and the precipitate is washed in due time with weak ammonia water. In general, however, as these conditions can seldom be fulfilled, they recommend to decant the supernatant liquid through the filter which is later to receive the precipitate, to dissolve this in as little hydrochloric acid as possible, to reprecipitate by dilute ammonia without further addition of magnesia mixture, and to wash finally with weakly ammoniacal water. Excess of ammonia, of ammonium salts, and of precipitant are all objectionable. In rock analysis the second precipitation will seldom be necessary. For ignition, etc., of the precipitate, see this subject under Magnesium (p. 66).

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[1] Am. Jour. Sci., 4th series, Vol. VII, p. 187, 1899; Zeitschr. für anorg. Chemie, Vol. XX, p. 121, 1899; Chemical News, Vol. LXXIX, pp. 233, 244, 255, 1899.

PROCEDURE WHEN MATERIAL IS SCANTY.

The following procedure admits of determining in the same portion, besides phosphorus, barium, iron, vanadium, chromium, and titanium, the last two either colorimetrically or gravimetrically, and is in large part extracted from a paper by Dr. T. M. Chatard.[1]

Silica is removed by hydrofluoric and sulphuric acids, excess of fluorine expelled, the residue brought into solution as far as possible with sulphuric or hydrochloric acid and hot water, filtered, the residue ignited, fused with sodium carbonate, dissolved in hydrochloric acid, and the solution, after precipitation of barium, added to the main one, which is now precipitated by ammonia to get rid of the magnesium salts usually present and thus insure a cleaner subsequent fusion with sodium carbonate.

The precipitated Al_2O_3, P_2O_5, Cr_2O_3, Fe_2O_3, and TiO_2 is dissolved in hot hydrochloric acid and filtered into a large platinum crucible, the filter burned and added, the solution evaporated to pastiness, a little water added to dissolve the salts, and dry sodium carbonate added in portions and stirred in thoroughly to prevent lumpiness in the fusion to follow, which is continued for half an hour. Addition of sodium nitrate is not necessary.

The fused mass is boiled out with water and washed with very dilute sodium-carbonate solution. In the residue iron and titanium can be determined by the methods already described. In the filtrate chromium can be determined colorimetrically if present in sufficient amount to give a pronounced color (see p. 80). Afterwards, or immediately if the chromium is not to be thus estimated, enough ammonium nitrate is added to react with all the carbonate and the solution is digested on the bath till most of the ammonium carbonate is gone. Nearly if not quite all alumina is thus thrown out, carrying with it all phosphorus. The precipitate is washed with dilute ammonium-nitrate solution till the yellow color wholly disappears, after which it is dissolved in nitric acid and the phosphorus thrown out by molybdate solution. The filtrate, containing chromium and vanadium, can be treated as detailed in the next following sections.

XVII. CHROMIUM.

If vanadium is absent, or nearly so, as is apt to be the case in those highly magnesian rocks (peridotites) usually carrying a good deal of chromium, the following separation and gravimetric method for chromium gives good and concordant results; but in presence of vanadium, and it is best generally to assume its presence, the colorimetric method should always be adopted.

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[1] Am. Chem. Jour., Vol. XIII, p. 106, 1891; Bull. U. S. Geol. Survey No. 78, p. 87; Chemical News, Vol. LXIII, p. 267, 1891.

GRAVIMETRIC METHOD.

Having obtained chromium in solution as chromate and free from all else but a little alumina, as at the conclusion of the preceding section on phosphorus, proceed as follows:

Concentrate if necessary and add fresh ammonium sulphide, or introduce hydrogen sulphide. The chromium is reduced and appears as a precipitate of sesquioxide mixed with the rest of the alumina. This precipitate is now treated according to Baubigny[1] by dissolving in nitric acid, evaporating to near dryness and heating with strong nitric acid and potassium chlorate, finally evaporating to dryness to get rid of the acid. Oxidation is complete and very speedy. On dilution with cold water, acid sodium carbonate is added in slight excess, and after two or three hours the precipitated alumina is filtered off. From the filtrate the chromium is then thrown out by fresh ammonium sulphide, redissolved and reprecipitated to free from alkali, and weighed.

The separation of aluminum from chromium by hydrogen peroxide in ammoniacal solution, as recommended by Jannasch and Cloedt,[2] has been shown by Friedheim and Brühl,[3] together with most of the other separations of Jannasch based on the use of hydrogen peroxide and from which so much was hoped, to be valueless.

COLORIMETRIC METHOD.

For this very accurate and by far the quickest method[4] for determining chromium in rocks and ores where the amount does not exceed a few per cent, there is needed the aqueous extract of a sodium-carbonate fusion of the rock (as obtained, for instance, under Phosphorus, p. 79) in order to compare its color with that of a standard solution.

Preparation and strength of standard solution.—This standard solution is made by dissolving 0.25525 gram or double that amount of pure potassium monochromate in one liter of water made alkaline by a little sodium carbonate. Each cubic centimeter then corresponds to one-tenth milligram or two-tenths milligram of chromic oxide (Cr_2O_3), in which condition chromium is usually reported in rocks and ores. It is probably inadmissible to increase the strength of the standard much above the figure given.

Preparation of the test solution.—Before filtering the aqueous extract of the sodium-carbonate fusion a few drops of alcohol (ethyl or methyl) are added to destroy the color of sodium manganate. If the yellow color of the filtrate is very faint, concentration by evaporation will strengthen it, and less than 2 milligrams of chromic oxide in 1 gram of rock can then be exactly measured. For smaller amounts it is best to employ from 3 to 5 grams of powder and then to concentrate the chromium by precipitation by mercurous nitrate, as detailed in the next section under Vanadium (p. 83); otherwise it may be difficult or impossible, because of the large amount of alkali carbonate present, to obtain a filtrate of sufficiently small bulk to show a decided color.

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[1] Bull. Soc. Chimique (n.s.), Vol. XLII, p. 291, 1884; Chemical News, Vol. L, p. 18, 1885.

[2] Zeitschr. für anorg. Chemie, Vol. X, p. 402, 1895.

[3] Zeitschr. für anal. Chemie, Vol. XXXVIII, p. 681, 1899.

[4] W. F. Hillebrand, Jour. Am. Chem. Soc., Vol. XX, p. 454, 1898; Chemical News, Vol. LXXVIII, pp. 227, 239, 1898; Bull. U. S. Geol. Survey No. 167, p. 37; first applied by L. de Koningh (Nederl. Tyds. voor Pharm. Chem. and Tox., 1889) for the estimation of chromium in foodstuffs.

If niter has been used in the fusion and the crucible has been at all attacked by it, a yellow coloration of the filtrate may be due to dissolved platinum, but neither the proportion of niter nor the temperature of the blast should ever be high enough to permit the crucible to be attacked.

Comparison of colors.—The final solution is transferred to a graduated flask of such size that its color shall be weaker than that of the standard chromium solution. Definite amounts of the latter are then diluted with water from a burette until of the same strength as the test solution, exactly as described on page 68 for the colorimetric estimation of titanium. For very minute amounts it is necessary to use Nessler tubes, as in ammonia estimations, instead of the glasses and apparatus described and depicted under Titanium (p. 70).

As with colorimetric methods in general, this one gives better results with small than with large percentages of chromium, yet it can be applied in the latter cases with satisfactory results by making a larger number of consecutive comparisons with the same solution.

A FEW COMPARATIVE DATA.

A few comparisons between colorimetric and gravimetric determinations of chromium are here given to show the order of agreement, the former having been made several months and even years after the latter.

Gravimetric per cent Cr_2O_3.	Colorimetric per cent Cr_2O_3.
Trace.	0.018
0.05	.051
.14	.12
.08	.033
Trace.	.013
None.	.0086
None.	.0067

The outcome was somewhat surprising, for it was hardly to be expected that the long and laborious quantitative separations should have resulted so well as they are shown to have done. It should be mentioned that for the gravimetric tests but one or two grams at most were used, which accounts for the reported absence of chromium in two instances, this report being based on the lack of color in the aqueous extract of the alkali fusion after removal of manganese.

XVIII. VANADIUM (CHROMIUM) AND MOLYBDENUM.

DISTRIBUTION OF VANADIUM AND MOLYBDENUM.

The wide distribution of vanadium thoughout the earth's crust has in recent years been clearly established (see ante, p. 18), not only in ores and in coals, but in clays, limestones, sandstones, and igneous rocks.[1] The writer has shown (loc. cit.) that vanadium occurs in quite appreciable amounts in the more basic igneous and metamorphic rocks up to 0.08 per cent or more of V_2O_3, but that it seems to be absent, or nearly so, from the highly siliceous ones. Some of their ferric aluminous silicate constituents carry still higher percentages—up to 0.13 per cent V_2O_3 in a biotite separated from a pyroxenic gneiss. Molybdenum, on the other hand, appears to be confined in quantities susceptible of detection to the more siliceous rocks, and, except perhaps in rare instances, is not present in them in quantitatively determinable amount when operating on 5 grams of material. Hence the quantitative search for vanadium will usually be limited to rocks with less than 60 per cent of silica. The search for it even then will perhaps not often warrant the necessary expenditure of time, but in this connection it is to be remembered that neglect to estimate it introduces an error in the figures for both ferrous and ferric oxides, which in extreme cases met with may be of considerable moment. (See p. 58, and also pp. 95–96.)

DESCRIPTION OF METHOD.

In the following method there is nothing absolutely novel except that chromium and vanadium, when together, need not be separated, but are determined, the former colorimetrically, as already described (p. 80), the latter volumetrically, in the same solution.[2]

Five grams of the rock are thoroughly fused over the blast with 20 of sodium carbonate and 3 of sodium nitrate. After extracting with water and reducing manganese with alcohol it is probably quite unnecessary, if the fusion has been thorough, to remelt the residue as above, though for some magnetites and other ores containing larger amounts of vanadium than the generality of rocks, this may be necessary, as Edo Claassen has shown.[1] The aqueous extract is next nearly neutralized by nitric acid, the amount to be used having been conveniently ascertained by a blank test with exactly 20 grams of sodium carbonate, etc., and the solution is evaporated to approximate dryness. Care should be taken to avoid overrunning neutrality, because of the reducing action of the nitrous acid set free from the nitrite produced during fusion, but when chromium is present it has been my experience that some of this will invariably be retained by the precipitated silica and alumina, though only in one case have I observed a retention of vanadium, it being then large. The use of ammonium nitrate instead of nitric acid for converting the sodium carbonate into nitrate does not seem to lessen the amount of chromium retained by the silica and alumina.

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[1] W. F. Hillebrand, Distribution and quantitative occurrence of vanadium and molybdenum in rocks of the United States: Am. Jour. Sci., 4th series, Vol. VI, p. 209, 1898; Chemical News, Vol. LXXVIII, p. 216, 1898; Bull. U. S. Geol. Survey No. 167, p. 49.

[2] W. F. Hillebrand: Jour. Am. Chem. Soc., Vol. XX, p. 461, 1898; Chemical News, Vol. LXXVIII, p. 295, 1898; Bull. U. S. Geol. Surv., No. 167, p. 44.

As a precautionary measure, therefore, and always when chromium is to be estimated also, the silica and alumina precipitate should be evaporated with hydrofluoric and sulphuric acids, the residue fused with a little sodium carbonate and the aqueous extract again nearly neutralized with nitric acid and boiled for a few moments, the filtrate being added to the main one.

Mercurous nitrate is now added to the cold alkaline solution in some quantity, so as to obtain a precipitate of considerable bulk, containing, besides mercurous carbonate, chromium, vanadium, molybdenum, tungsten, phosphorus, and arsenic, should all happen to be in the rock. The mercurous carbonate serves to counteract any acidity resulting from the decomposition of the mercurous nitrate. Precipitating in a slightly alkaline instead of a neutral solution, renders the addition of precipitated mercuric oxide unnecessary for correcting this acidity. If the alkalinity, as shown by the formation of an unduly large precipitate, should have been too great, it may be reduced by careful addition of nitric acid until an added drop of mercurous nitrate no longer produces a cloud.

After heating and filtering, the precipitate is ignited in a platinum crucible, after drying and removing from the paper to obviate any chance of loss of molybdenum and of injury to the crucible by reduction of arsenic. The residue is fused with a very little sodium carbonate, leached with water, and the solution, if colored yellow, filtered into a graduated flask of 25 or more cubic centimeters capacity. The chromium is then estimated accurately in a few minutes by comparing with a standard alkaline solution of potassium monochromate (p. 80). Then, or earlier in absence of chromium, sulphuric acid is added in slight excess and molybdenum and arsenic, together with occasional traces of platinum, are precipitated by hydrogen sulphide, preferably in a small pressure bottle.[1] If the color of the precipitate indicates absence of arsenic the filter with its contents is carefully ignited in porcelain, and the delicate sulphuric-acid test for molybdenum is applied as follows: The molybdenum compound is heated in porcelain with a single drop of strong sulphuric acid till the acid is nearly volatilized. On cooling a beautiful blue color is proof of the presence of molybdenum.

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[1] Am. Chem. Jour., Vol. VIII, p. 437, 1886.

The filtrate, in bulk from 25 cm.^{3} to 100 cm.^{3} is boiled to expel hydrogen sulphide, and titrated at a temperature of 70° to 80° C. with a very dilute solution of permanganate representing about 1 mg. of V_2O_5 per cubic centimeter as calculated from the iron strength of the permanganate, one molecule of V_2O_5 being indicated for each one of Fe_2O_3. One or two checks are always to be made by reducing again by means of a current of sulphur dioxide gas, boiling this out again,[2] and repeating the titration. The latter results are apt to be a very little lower than the first and are to be taken as the correct ones.

In case the volume of permanganate used is so small as to make doubtful the presence of vanadium, it is necessary to apply a qualitative test, which is best made as follows: The solution is evaporated and heated to expel excess of sulphuric acid, the residue is taken up with two or three cubic centimeters of water and a few drops of dilute nitric acid, and a couple of drops of hydrogen peroxide are added. A characteristic brownish tint indicates vanadium. Unless the greater part of the free sulphuric acid has been removed the appearance of this color is sometimes not immediate and pronounced, hence the above precaution. It is also necessary that the nitric acid shall be in considerable excess, since in a neutral or only faintly acid solution the color does not appear strongly.

The above is a surer test to apply than the following: Reduce the bulk to about 10 cubic centimeters, add ammonia in excess and introduce hydrogen sulphide to saturation. The beautiful cherry-red color of vanadium in ammonium-sulphide solution is much more intense than that caused by hydrogen peroxide in acid solution, but the action of ammonia is to precipitate part or all of the vanadium with the chromium or aluminum that may be present or with the manganese used in titrating, and ammonium sulphide is unable to extract the vanadium wholly from these combinations. Usually, however, the solution will show some coloration, and addition of an acid precipitates brown vanadium sulphide, which can be collected, ignited, and further tested if desired.

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[1] From a sulphuric solution the separation of platinum and molybdenum by hydrogen sulphide is much more rapid and satisfactory than from a hydrochloric solution.

[2] The direct use of a solution of sulphur dioxide or of an alkali sulphite is inadmissible unless these have been freshly prepared, since after a lapse of time they contain other oxidizable bodies than sulphurous acid or a sulphite. The sulphur dioxide is best obtained as wanted by heating a flask containing a solution of sulphur dioxide, or of a sulphite to which sulphuric acid has been added.

The expulsion of the last traces of sulphur dioxide is said to be more effectively accomplished by boiling with simultaneous passage of a rapid current of carbon dioxide for a few minutes at the last than by boiling alone. Because of the small amount of air carried with it, long passage of the gas is said to result in slight oxidation of the vanadium (Manasse, Ann. Chem. u. Pharm., Vol. CCXL, p. 23, 1887; Zeitschr. für anal. Chemie, Vol. XXXII, p. 225, 1893).

APPLICATION OF THE METHOD IN PRESENCE OF RELATIVELY MUCH CHROMIUM.

The application of the method in its foregoing simplest form is subject to one limitation—the chromium must not be present above a certain moderate amount. This limitation is due to the considerable amount of permanganate then required to produce a clear transition tint when titrating in a hot solution, as is advisable with vanadium. In a cold solution of chromic sulphate much less permanganate is needed to produce the peculiar blackish tint without a shade of green, which affords a sure indication of excess of permanganate, but in a hot and especially a boiling solution the oxidation of the chromium itself takes place so rapidly that a very large excess of the reagent may be added before a pronounced end reaction is obtained. Nevertheless, quite satisfactory determinations of as little as one or two milligrams of vanadium pentoxide can be made in presence of as much as 30 milligrams of chromic oxide. To accomplish this it is only necessary to apply a simple correction obtained by adding permanganate to a like bulk of equally hot chromic sulphate solution containing approximately the same amount of chromium.

Ridsdale[1] titrated the cold solution to avoid oxidation of chromium, and obtained accurate results, but in the writer's experience the end reaction is then uncertain.

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[1] Jour. Chem. Soc., Vol. VII, p. 73, 1888.

The following tables contain the results of a considerable number of tests, those in Table II being tabulated separately in order to show the degree of accuracy attainable with a large excess of chromium by applying the correction above mentioned and also the amount of this correction:

TABLE I.

Tests for vanadium in the presence of chromium.

No.	Chromic oxide.	Vanadium pentoxide.	Vanadium pentoxide found.	Error.
	Milligrams.	*Milligrams.*	*Milligrams.*	*Milligram.*
1	1	9.87	9.22	-0.15
2	1	.94	1.04	+ .10
			.98	+ .04
3	1.5	5.25	5.49	+ .24
			5.43	+ .19
4	2	5.62	5.5	- .12
			5.5	- .12
5	3	4.68	4.78	+ .10
			4.78	+ .10
			4.83	+ .15
6	3	5.62	5.58	- .04
			5.58	- .04
7	3.5	18.74	18.89	+ .15
			18.97	+ .23
8	6	5.6	6.1	+ .50
9	6	4.68	4.78	+ .10
10	6	5.62	5.58	- .04
11	10	5.62	5.58	- .04
12	10	23.52	23.81	+ .29
			23.71	+ .19
13	10	46.85	46.98	+ .13
			47.20	+ .35
14	25	23.52	23.65	+ .13
			23.75	+ .23
15	87.5	23.52	23.71	+ .19

TABLE II.

Showing application of correction for larger amounts of chromium, obtained by adding potassium permanganate to an equal bulk of solution containing a like amount of chromic sulphate.

No.	Chromic oxide.	Vanadium pentoxide.	Vanadium pentoxide found.	Vanadium pentoxide found.	Error.	Volume of solution.
	Milligrams.	*Milligrams.*	*Uncorrected.*	*Corrected.*	*Milligram.*	
16	20	0.94	1.59	0.99	+0.05	50–100 cm.^{3}
17	20	1.87	2.69	2.09	+ .22	50–100 cm.^{3}
			2.39	1.79	− .08	
			2.59	1.99	+ .12	
18	20	18.74	19.4	18.73	− .01	50–100 cm.^{3}
			19.3	18.63	− .11	
			19.3	18.63	− .11	
19	30	1.87	2.99	2.14	+ .27	About 100 cm.^{3}
			2.79	1.94	+ .07	
			2.79	1.94	+ .07	
			2.69	1.84	− .03	
			2.69	1.84	− .03	
20	30	1.87	2.69	1.79	− .08	200 cm.^{3}
			2.89	2.09	+ .22	
			2.89	2.09	+ .22	
			2.79	1.99	+ .12	
21	62	46.85	48.60	47.60	+ .75	200 cm.^{3}

In spite of the fact that the correction in most of the trials of this last table represents a large proportion of the permanganate used, the results must be considered satisfactory in view of the small amount of vanadium present, and they show that the method in competent hands after a little experience affords trustworthy figurès.

The method of T. Fischer[1]—digestion of the precipitated lead salts with a strong solution of potassium carbonate—appears to offer the long-needed satisfactory quantitative separation of arsenic, phosphorus, chromium, tungsten, and molybdenum from vanadium, the normal lead meta-vanadate remaining quite unattacked, according to the author, while the other lead salts are wholly decomposed, but the applicability of this method to the separation of the minute amounts often found in rocks and ores has not been tested. The object has been in the present case to reach satisfactory results with the greatest expedition, and when chromium is not present in considerable amount this is accomplished.

Fortunately, chromium is almost never a prominent constituent of clays, coals, iron ores, and those rocks in which vanadium has thus far been reported, for although it is usually certain of the most basic of the silicate rocks that are highest in chromium—as the peridotites—yet in these, so far as present experience teaches, vanadium is lacking, a fact doubtless connected with the simultaneous absence from them of ferric-aluminous silicates.

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[1] Inaugural Dissertation, Rostock, 1894.

CONDITION OF VANADIUM IN ROCKS.

The above and elsewhere mentioned connection of vanadium with the ferric-aluminous silicates of rocks, taken in connection with the existence of the mineral roscoelite, classed as a vanadium mica, indicates a condition of the vanadium corresponding to aluminum and ferric iron, and that it is to be regarded as replacing one or both of these elements. Hence it should be reported as V_2O_3 and not as V_2O_5.

What its condition may be in matter of secondary origin, like clays, limestones, sandstones, coals, and ores of iron, is yet open to discussion. It was the writer's opinion until recently, that it should then be regarded as in the pentavalent state (V_2O_5), but his work upon certain remarkable vanadiferous sandstones[1] of western Colorado, in which it unquestionably occurs as trivalent vanadium (V_2O_3), has led to a decided unsettling of this view. It is but proper to recall that Czudnowicz,[2] because of the extreme difficulty in completely extracting it from iron ores by an alkali-carbonate fusion and because of the easy reducibility of vanadic acid by ferrous salts, under the conditions in which brown iron ores are supposed to form, considered the vanadium in such ores to be in a lower condition of oxidation (V_2O_3). Lindemann's[3] contrary conclusion with regard to certain iron ores, because the vanadium was extracted as V_2O_5 by sodium-carbonate fusion without niter, is not valid, since this would probably be the case even if it existed in the ore as V_2O_3.

XIX. FERROUS IRON.

COMPARISON OF SEALED-TUBE AND HYDROFLUORIC-ACID METHODS—COMPARATIVE WORTHLESSNESS OF THE FORMER IN ROCK ANALYSIS.

No point in rock analysis has been the cause of greater solicitude to the chemist, and especially to the mineralogist and petrographer, than the determination of iron in ferrous condition. The sealed-tube or Mitscherlich method with sulphuric acid, for a long time the only available one, is in theory perfect, since complete exclusion of oxygen is easily attainable. Its chief hitherto recognized defect lies in the inability to always secure complete decomposition of the iron-bearing minerals, and even to ascertain, oftentimes, whether or not the decomposition has been complete. The addition of hydrofluoric acid to the sulphuric in the tube, in order to insure this breaking up, is to be regarded as of very doubtful utility in most cases, since the glass may be so strongly attacked as to add an appreciable amount of iron to the solution, and the hydrofluoric acid may have exhausted itself in attacking the glass before the more refractory minerals succumb. Nevertheless, if decomposition can be effected by sulphuric acid alone the results obtained are sharp and concordant, and what has seemed especially remarkable, and up to almost the present moment without a satisfactory explanation, they are in rock analysis usually higher than when made by any of the modifications of the hydrofluoric-acid method now so extensively practiced. This difference is not very marked with rocks containing but 1 or 2 per cent of ferrous iron, but it increases with rising percentage to such an extent that where the sealed-tube method will show 12 per cent FeO the other may indicate no more than 10 per cent. This is a fact of which the writer has long been cognizant, but it does not seem to be known to chemists or petrographers at large, though Wülfing[1] has noticed this difference in certain analyses without appreciating its significance. Experiments with soluble iron salts of known composition, like ferrous sulphate and ferrous-ammonium sulphate, throw no light on the subject, for both methods give with them the same sharp and accurate results.

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[1] Hillebrand and Ransome: Am. Jour. Sci., 4th series, Vol. X, p. 120, 1900.

[2] Pogg. Ann., Vol. CXX, p. 20, 1863.

[3] Dissertation, Jena. 1878, through Zeitsch. für anal. Chemie, Vol. XVIII, p. 99, 1879

In spite of several attempts to find a solution to the problem, none presented itself until very recently, when, as a result of observations made in this laboratory by Dr. H. N. Stokes in a pending investigation on the action of ferric salts on pyrite and other sulphides, the clue was given. Dr. Stokes found that ferric salts exercise a most marked oxidizing effect on pyrite and probably other sulphides. The reaction is not new (see J. H. L. Vogt in Zeitschr. für prakt. Geol., 1899, pp. 250–251), but the ease with which the change takes place and the completeness of the oxidation of the pyrite, not only of its iron but of the greater part of the sulphur as well, were entirely unexpected. Pure pyrite itself is attacked with extreme slowness by boiling dilute sulphuric and hydrofluoric acids, either alone or mixed, but the moment a ferric salt is introduced the case is altogether different.

However, experiment has shown (p. 95) that with the amounts of sulphides usually found in igneous rocks their effect upon the estimation of ferrous iron by the hydrofluoric-acid method at atmospheric pressure and boiling heat is negligible, though by increasing the amount of sulphide the effect becomes more and more apparent, because of the greater surface of pyrite exposed to the action of the ferric iron of the rock.

Under the conditions of the Mitscherlich method, on the other hand—a temperature of 150 to 200° C., and even higher, high pressure, much longer time of action, and impossibility of escape of any hydrogen sulphide that may be formed—the sulphur of the sulphides becomes nearly, if not fully oxidized to sulphuric acid at the expense of the ferric iron in the rock, with the production of an equivalent amount of ferrous iron in addition to that resulting from the sulphide itself. Now, rocks with hardly an exception, and many minerals, carry pyrite or pyrrhotite, or both, often in considerable amount, often in traces only. My own experience has been that sulphur can almost always be detected in 2 grams of rock powder.

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[1] Ber. deutsch. chem. Gesell., Vol. XXXII, p. 2217, footnote, 1899.

Let us now see what the effect of these traces when fully oxidized amounts to. One atom of sulphur (32) requires for its complete conversion to trioxide the oxygen of three molecules of ferric oxide (480), which then becomes six molecules of ferrous oxide (432). In other words, 0.01 per cent of sulphur may cause the ferrous oxide to appear too high by 0.135 per cent, and 0.10 per cent of sulphur may bring about an error of 1.35 per cent in ferrous oxide. The case is still worse if the sulphur is set free as hydrogen sulphide from a soluble sulphide, for then the above percentages of sulphur produce errors of 0.18 and 1.8 per cent, respectively, in the ferrous oxide determination.

The error caused by sulphides tends to become greater the more there is present of either or both sulphide and ferric salt. Now, the highly ferruginous rocks usually carry more ferric iron than the less ferruginous ones, and they are often relatively high in pyrite and pyrrhotite; hence the increasing discrepancy between the results by the two methods as the iron contents of the rocks rise is fully in accord with the above explanation.[1]

Notwithstanding that the Mitscherlich method has thus been discredited in its general applicability to rocks and minerals, it is still capable of affording valuable assistance with those which are totally free from sulphides. Hence the conditions under which success can best be achieved by it are set forth in the following paragraphs.

THE MODIFIED MITSCHERLICH METHOD.

Strength of acid.—The method in its original and usual application calls for a mixture of three parts of sulphuric acid and one of water by weight, or about three to two by volume, though a still stronger acid is sometimes used. In some cases, however, perhaps in most, much better decomposition of the silicates is effected by reversing the proportions of water and acid, or at any rate by diluting considerably beyond the above proportion. Hereby the separation of salts difficultly soluble in the stronger acid is avoided and the actual solvent effect on the minerals seems to be in no wise diminished.

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[1] For details of experiments showing the worthlessness of the Mitscherlich method for rocks and minerals which contain even a trace of free sulphur or sulphides, see Hillebrand and Stokes, in an as yet unpublished paper in Jour. Am. Chem. Soc., Vol. XXII, p. 625, and Zeitschr. für anorg. Chem., Vol. XXV, p. 326, 1900, entitled, Relative value of the Mitscherlich and hydrofluoric-acid methods for ferrous iron determinations.

Filling, sealing, and heating of the tube.—The very finely powdered mineral having been introduced into a tube of resistant glass free from ferrous iron, the open end is drawn out, so as to leave a funnel for the introduction of the acid. A very little water is then introduced and carefully heated to boiling for a moment to expel all air from the powder. The diluted acid—which has just been boiled down from a state of greater dilution in order to have it free from air—is then poured in until the tube is about three-fourths filled. Carbon dioxide is then introduced from a generator which has been in active operation for some time, through a narrow glass tube drawn out of the same kind of glass as that of which the decomposing tube consists. In a few moments the air is expelled, and the small tube is then sealed into the large one over the blast lamp without interrupting the gas current until the very last instant, when to prolong it would perhaps cause a blowing out of the softened glass. The interruption of the current at the proper moment is easily effected by the pressure of the thumb and finger holding the small tube at the point where it enters the rubber tube leading from the gas generator. No breakage in the oven ever occurs as a consequence of thus fusing one tube into the other.

The heating is done in a bomb oven at any desired temperature up to, say, 200° C., and continued at intervals until examination by aid of a low-power lens shows that decomposition is complete or has progressed as far as can be hoped for. By inclosing the glass in an outer tube of strong steel, properly capped[1] and containing a little ether or benzine to equalize the pressure on both sides of the glass, the temperature can be elevated far beyond what is otherwise permissible, and the decomposition will then doubtless be more complete with refractory silicates.

Reason for introducing gas and sealing as above directed.—The usual practice in employing the above method has been to expel air before sealing by introducing a few crystals or lumps of an alkali carbonate or bicarbonate, the gas set free on their contact with the acid being supposed to effectively expel all air. That this is not accomplished the following series of comparative results long since published elsewhere[2] fully show. The material used was the oxide of uranium U_3O_8, requiring by theory 32.07 per cent of UO_2. Operating as just above described on from 0.3 to 0.5 gram, the results were

31.06, 31.07, 29.72, 29.33, 29.89, 30.69,

whereas after filling the tube with gas from a generator there was found

32.11, 31.90, 32.15, 32.12, 32.06, 32.17, 32.28,

the average error of the former series being 1.78 per cent. The percentage error would, of course, be reduced by increasing the weight of mineral operated on. An average error equal to the above when employing 1 gram of ferrous minerals would make the percentage for FeO about 0.3 per cent too low. While the absolute error might be the same in all cases, the relative error would increase with minerals low in ferrous iron.

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[1] Ullmann, Zeitschr. für angew. Chemie, 1893, p. 274; Zeit. für anal Chemie, Vol. XXXIII, p. 582, 1894.

[2] Bull. U. S. Geol. Survey, No. 78 p. 50; Chemical News, Vol. LXIV, p. 232, 1891.

THE HYDROFLUORIC-ACID METHOD.

This method is the one which has been almost exclusively used since the earliest years of the Survey's existence.

The specially ground powder, in a capacious crucible, is placed, after stirring up with dilute sulphuric acid, on a small water bath of a single opening (fig. 13) and covered with a glass funnel, the stem of which has been cut off near the flare, resting in a depression of the specially made cover, into which water constantly drops from a tubulated bottle, thus securing a perfect water joint and serving to keep the bath full. Through a small metal pipe carbonic-acid gas flows into the bath above the surface of the water, and rising through orifices in the cover fills the funnel and crucible.[1] The lamp under the bath is lighted and hydrofluoric acid is poured into the crucible through a platinum funnel, which is left in place to serve as an occasional stirrer, for which a rod or wire may be substituted. After boiling commences the rapid gas current can be safely interrupted, to be restored when the lamp is extinguished after one-half to one or more hours. A full stream of cold water is then caused to flow from the tubulated bottle into the bath, the overflow from the outlet tube being caught in a receiver. As soon as cool the contents of the crucible are emptied into a platinum dish containing cold water, and titrated till the first permanent color appears, which usually will last for only a few seconds. Duplicate determinations are to be advised whenever possible, since even with the utmost care the results will occasionally differ more than is allowable.

In absence of a suitable water bath an ordinary one can be used covered with a beaker, through a hole in the bottom of which a strong current of carbon dioxide is introduced, or the crucible may be set in a sand bath and covered in the same way with a broken beaker (Doelter).

The cause of the rapid disappearance of the first pink blush when titrating in hydrofluoric-sulphuric solution appears to be the ready oxidizability of manganous fluoride by permanganate. The latter can be added by the cubic centimeter to solutions already containing manganous sulphate in presence of hydrofluoric acid without producing a more than passing pink blush. The solution, however, takes on in ever-increasing intensity the red-brown color characteristic of manganic salts. The decolorization due to this cause is hence much more pronounced in the case of rocks high in ferrous iron than of those low in this constituent, because of the greater amount of manganous salt resulting from reduction of a correspondingly larger amount of permanganate.

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[1] J. P. Cooke, Am. Jour. Sci., 2d series, Vol. XLIV, p. 347, 1867.

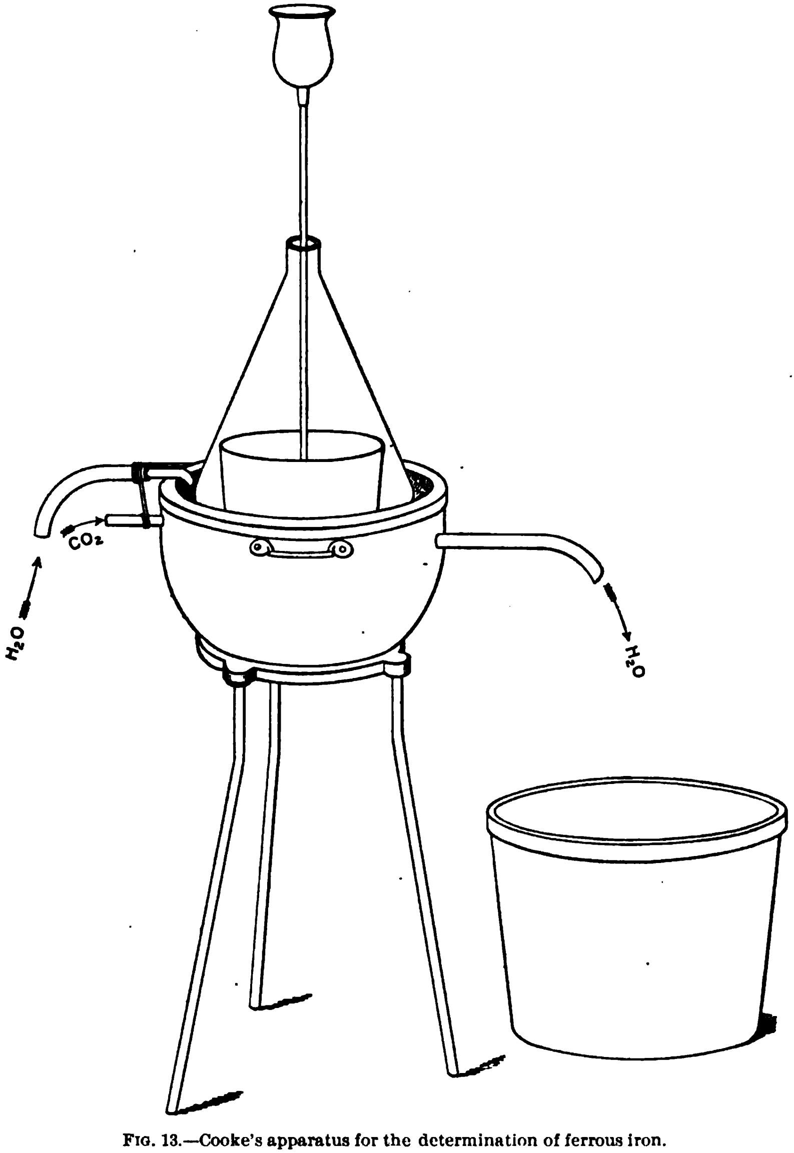

Fig. 13.—Cooke's apparatus for the determination of ferrous iron.

When pyrite is present the bleaching is in part due to its action on any permanganate added in excess of the requirements of the ferrous oxide. But this action is not so immediate as to affect the ferrous oxide determination if the end point in the latter has been properly observed.

PRATT'S MODIFICATION OF THE HYDROFLUORIC-ACID METHOD.

J. H. Pratt[1] has shown that very satisfactory ferrous iron determinations can be secured by simple boiling of the rock powder with hydrofluoric and sulphuric acids in a large crucible fitted with a cover and platinum tube for introduction of carbon dioxide. His test experiments on ferrous sulphate show that there need be practically no oxidation, even if the heating lasts several hours. The directions given on page 150 of his paper, with reference to the treatment of very refractory minerals which are not fully decomposed by this treatment, must be understood as referring only to homogeneous minerals and not to rocks, where the relations of ferrous and ferric iron in the undecomposed portion are certainly different from those in the part dissolved.

INFLUENCE OF SULPHIDES, VANADIUM, AND CARBONACEOUS MATTER ON THE DETERMINATION OF FERROUS IRON BY THE HYDROFLUORIC-ACID METHOD.

A dark color of the undissolved residue may be due to pyrite, graphite, or carbonaceous matter. The first of these affects the result but little, the second probably not at all, and they can be distinguished by their behavior toward nitric acid. Organic matter of course renders impossible the estimation of ferrous iron.

Sulphides.—Pyrite, in the quantities usually met with in igneous rocks, is probably without serious effect on the ferrous-iron determination by any of the hydrofluoric-acid methods. This sulphide is very resistant toward attack in the absence of oxygen, as is shown by the fact that if present in any quantity it can be readily recognized in the residue after titration. In any case it is impossible to allow for an error introduced by its possible decomposition, and the result of titration must count as ferrous iron. In the case of soluble sulphides two sources of error are introduced—that of reduction of ferric iron by hydrogen sulphide evolved, and that due to the ferrous iron which the sulphides themselves may contain, especially if pyrrhotite is present. The first of these is perhaps negligible, since most of the hydrogen sulphide would probably be expelled without reducing iron. The second is approximately measurable if it is known that pyrrhotite is the only soluble sulphide present, and its amount has been ascertained by determining the hydrogen sulphide set free on boiling with hydrochloric acid in a current of carbon dioxide. In this case a correction is to be applied to the result of titration for total ferrous iron. (See also p. 106, under Sulphur.)

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[1] Am. Jour. Sci., 3d series, Vol. XLVIII, p. 149, 1894.

In order to obtain quantitative data regarding the effect of pyrite on the ferrous-iron estimation by the hydrofluoric-acid method the following tests were recently made: Part of a fine crystal of pyrite was rather finely powdered and boiled with dilute sulphuric acid, which extracted considerable ferrous iron, derived presumably from admixed or intergrown pyrrhotite, since a second boiling with fresh acid gave a negative test for ferrous iron. After washing by decantation with water, followed by alcohol and ether, the powder was dried and further pulverized. A quarter of a gram of it when treated with hydrofluoric and sulphuric acids in a large crucible by the Cooke method for ferrous iron, then rapidly filtered through a very large perforated platinum cone fitted with filter paper, required but 2 drops of a permanganate solution representing only 0.0032 gram FeO to the cubic centimeter.

Since, however, Dr. H. N. Stokes has found in a pending investigation that the oxidizing effect of ferric salts on pyrite and other sulphides is vastly greater than seems to have been suspected (see p. 89), the following tests were made in order to ascertain the probable error due to this action under the conditions prevailing in rock analysis: Successive portions of 1 gram each of a hornblende-schist, free from sulphur and carrying 10.09 per cent FeO as the mean of several determinations and 4.00 per cent Fe_2O_3, were mixed in a large (50 cm.^{3}) platinum crucible with 0.02, 0.025, and 0.10 gram, respectively, of the above purified pyrite powder, and treated with hydrofluoric and sulphuric acids by the Cooke method, the water bath being at boiling heat for one hour. The cooled contents of the crucible were poured into a platinum dish containing water and titrated rapidly nearly to an end. Then, in order to get rid of the pyrite, which would obscure the end reaction by its reducing effect on the pemanganate, the solution was filtered as above and in the clear filtrate the titration was carried to completion. The results were 10.02, 10.16, and 10.70. Inasmuch as the smallest of these three charges of pyrite was several times greater than what may be considered an unusually high amount for an igneous rock, it is very evident that for all practical purposes the influence of pyrite on the ferrous estimation by the Cooke method is negligible. At the same time it is to be borne in mind that with increased content in ferric iron an increased amount of pyrite will be attacked, and that the extent of this attack is undoubtedly influenced by the degree of fineness of the pyrite powder.

Vanadium.—If vanadium, when present, exists in the trivalent condition, it necessarily affects with an error varying with its amount the result of titration for ferrous iron. Knowing the amount of vanadium a correction can be applied as follows: One molecule of V_2O_3 (150.8) in oxidizing to V_2O_5 requires as much oxygen as four molecules of FeO (288) when oxidized to Fe_2O_3. The proportion, 150.8 : 288 : : V_2O_3 present : x, therefore gives the figure to be deducted from the uncorrected value for FeO. That this correction is very needful with many of the basic rocks becomes at once evident from the following perhaps extreme example:

Found 2.50 per cent apparent FeO in a rock containing .13 per cent V_2O_3.
Deduct .25 per cent FeO equivalent in its action on $KMnO_4$ to .13 V_2O_3.
Leaving 2.25 per cent FeO corrected.
Found 5.00 per cent apparent total iron as Fe_2O_3 in the same rock.
Deduct .14 per cent Fe_2O_3 corresponding to .13 per cent V_2O_3.
Leaving 4.86 per cent corrected total iron as Fe_2O_3.
Deduct 2.50 per cent Fe_2O_3 equivalent to 2.25 per cent FeO.
Leaving 2.36 per cent Fe_2O_3 in the rock.

Failure to correct for the vanadium in both cases would have made the figures for FeO and Fe_2O_3, respectively, 2.50 and 2.22 instead of 2.25 and 2.36 as shown above.

Carbonaceous matter.—As said before (p. 94), matter of organic origin other than graphitic carbon renders the results of the ferrous iron determination altogether unreliable.

UNCERTAINTIES OF THE FERROUS IRON DETERMINATION.

From the foregoing it is apparent that, despite the utmost care in practical manipulation, the exact estimation of ferrous iron in rocks is one fraught with extraordinary difficulties and uncertainties. Only in absence of decomposable sulphides, and when the amount and condition of vanadium are known, can the result be regarded as above suspicion.

XX. ALKALIES.

THE LAWRENCE SMITH METHOD.

The various methods for getting at the alkalies in insoluble silicates differ more in the mode of attack of the mineral powder and in the immediately subsequent treatment than in the final stages. With very few exceptions, since the early days of the Survey's existence, all alkali determinations have been made by the method of J. Lawrence Smith,[1] which is far more convenient than and fully as accurate as those in which decomposition is effected by hydrofluoric and sulphuric acids, or by bismuth, lead, or boric oxides. One of its chief advantages is the entire elimination of magnesia at the start.

Decomposition of the powder is effected by heating it with its own weight of ammonium chloride and eight times as much precipitated calcium carbonate.

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[1] Am. Jour. Sci., 2d series, Vol. L, p. 269, 1871; Am. Chemist, Vol. I, 1871; Annalen Chem. und Pharm., Vol. CLIX, p. 82, 1871.

The ammonium chloride used must be purified, preferably by sublimation, or made by neutralizing pure ammonia by pure hydrochloric acid, and the calcium carbonate is best obtained from pure calcite by solution and reprecipitation. However obtained, this last is rarely free from alkalies, which must be estimated once for all in a blank test in order to apply a correction. Eight grams of the carbonate will contain usually from 0.0012 to 0.0016 gram of alkali chlorides, almost entirely the sodium salt, but the amount has been brought down to half the above by very long washing. This correction may be admitted at once to be a defect of the method, but it is one easily applied with safety.

The ignition may be made in a covered crucible of ordinary shape and of about 20 to 30 cm.^{3} capacity, heated to dull redness for not more than two-fifths of its height, but the heat has to be kept so low in this case to avoid loss by volatilization that perfect decomposition is not always assured. Hence, to avoid waste of time in very fine grinding, the form of crucible with cap originally advocated by Smith is very much to be preferred, since it permits, when set at an angle through an opening in the side of a fire-clay cylinder, of the application of the full heat of two burners, and perfect decomposition invariably results without the need of extraordinary care in grinding. The crucible used in this laboratory (fig. 14) for one-half gram of rock powder and 4 grams calcium carbonate is 8 cm. long, 1.8 cm. wide at the mouth, and 1.5 at the bottom. For double the amounts or more the dimensions are 8 cm., 2.5 cm., and 2.2 cm. The weights are 25 and 40 grams.

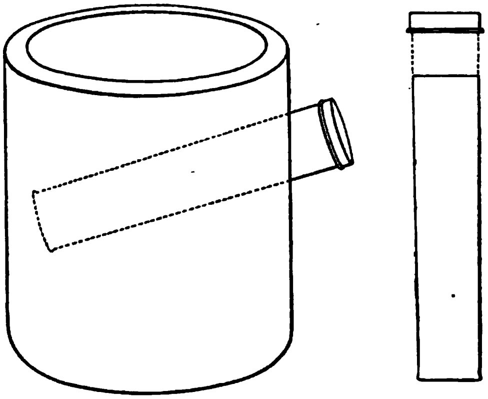

FIG. 14.—The J. Lawrence Smith crucible for alkali determinations. For dimensions see text.

Treatment of the mineral powder.—Perfectly satisfactory results are to be obtained with but a half gram of rock powder. This is weighed out, ground down somewhat finer in a large agate mortar, mixed with its own weight of sublimed ammonium chloride, and the two thoroughly ground together. Then nearly all of 4 grams of calcium carbonate is added and the grinding continued till a thorough mixing has resulted. The contents of the mortar are transferred to the long crucible, the rest of the carbonate being used for rinsing off mortar and pestle. The crucible is then capped and placed in a clay cylinder (fig. 14), or through a hole in a piece of stout asbestos board clamped in a vertical position, and heated for about ten minutes by a low, flat flame placed at considerable distance beneath. As soon as the odor of ammonia is no longer perceptible the nearly full flame of two Bunsen burners is applied, and continued for forty to fifty minutes. The sintered cake[1] detaches readily from the crucible as a rule; if not, it is softened up in a few minutes by hot water and digested in a dish until thoroughly disintegrated. It is first washed by decantation, and any lumps are broken up by a pestle, then thrown on the filter and well washed with hot water. The residue should dissolve completely in hydrochloric acid without showing the least trace of unattacked mineral, not even of quartz.

Separation of calcium and sulphuric acid.—All but a trifling amount of the calcium is separated at boiling heat in a large platinum dish by double precipitation by ammonia and ammonium carbonate. The combined filtrates are evaporated to dryness and the ammonium salts are carefully driven off. From the aqueous solution of the residue—but a few cubic centimeters in bulk—the rest of the calcium is thrown out by ammonia and ammonium oxalate, this last being more effective than the carbonate. The filtrate, caught in an untared platinum crucible or small dish, is evaporated to dryness and gently ignited; the residue is moistened with hydrochloric acid to decompose any alkali carbonate that may have been formed, again evaporated, ignited, and weighed. On solution in water a few tenths of a milligram of fixed residue is invariably left, which should be collected, ignited, and weighed in the same crucible or dish in order to arrive at the weight of the chlorides.

If the rock contains sulphur this will be in part found with the chlorides as sulphate. Therefore, if the sulphur is at all considerable in amount it must be removed by a drop of barium chloride before the final precipitation of the calcium. The excess of barium is removed by ammonium carbonate and the last of the calcium by ammonium oxalate, as above. If the sulphur is not thus removed there is danger, if not certainty, of the potassium-platinic chloride carrying sodium sulphate. A faint reaction for sulphate can usually be obtained anyway, if the evaporations have been made on a water bath heated by gas.

Precipitation of potassium.—To the solution of the chlorides in a small porcelain[2] dish an excess of platinic chloride solution is added. The dilution should be such that when heated on the water bath any precipitate that may form wholly redissolves. Evaporation is then carried on till the residue solidifies on cooling. It is then drenched with absolute alcohol[1] or with that of 80 per cent strength, filtered by decantation through a very small filter and washed by decantation with alcohol of the same strength. The precipitate is not brought onto the filter more than can be avoided. Dish and filter are then dried for a few minutes to remove adhering alcohol, the contents of the former are transferred to a weighed platinum crucible or very small dish, and what still adheres to the porcelain is washed through the filter with hot water into the weighed receptacle. This is now placed on the water bath and afterwards heated to 135° C. in an air bath. The factor used for reduction of K_2PtCl_6 to 2 KCl is 0.307 and of 2 KCl to K_2O, 0.632.

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[1] To avoid the formation of a melted cake with silicates very high in iron it is advisable to increase the proportion of calcium carbonate.

[2] Preferred to platinum because of the possibility, under certain rare and ill-understood conditions, of the formation of an insoluble subchloride of platinum, probably by reaction between the platinum of the dish and that of the salt. (See also Bohn, Zeitschr. für anal. Chemie, Vol. XXXVIII, p. 349, 1899.)

LITHIUM.

After separation of the potassium platinic chloride, the alcoholic filtrate is evaporated and tested spectroscopically for lithium. This element is almost invariably present, but almost never in amount to warrant quantitative estimation. Should it be so, however, the very excellent Gooch method (summarized below) of separation by amyl alchohol is to be followed, after removal of the platinum by hydrogen gas.[2] In rock analysis there need be no fear of enough lithium falling with the potassium to cause any concern.

If ammonium carbonate alone has been relied on to separate all calcium (ante, p. 98) the few tenths of a milligram of calcium chloride that escaped precipitation can now be found with the sodium.

GOOCH'S METHOD[3] FOR SEPARATING LITHIUM.

To the concentrated solution of the chlorides amyl alcohol is added and heat is applied, gently at first, to avoid danger of bumping, until, the water disappearing from solution and the point of ebullition rising and becoming constant for some minutes at a temperature which is approximately that at which the alcohol boils by itself, the chlorides of sodium and potassium are deposited and lithium chloride is dehydrated and taken into solution. At this stage in the operation the liquid is cooled and a drop or two of strong hydrochloric acid added to reconvert traces of lithium hydrate in the deposit, and the boiling continued until the alcohol is again free from water. If the amount of lithium chloride present is small, it will now be found in solution and the chlorides of sodium and potassium will be in the residue, excepting the traces for which correction will be made subsequently. If, however, the weight of lithium chloride present exceeds 10 or 20 milligrams, it is advisable at this point, though not absolutely essential to the attainment of fairly correct results, to decant the liquid from the residue, wash the latter a little with anhydrous amyl alcohol, dissolve in a few drops of water, and repeat the separation by boiling again in amyl alcohol. For washing, amyl alcohol, previously dehydrated by boiling, is to be used, and the filtrates are to be measured apart from the washings. In filtering it is best to make use of the perforated crucible and asbestos felt, and apply gentle pressure. The crucible and residue are ready for the balance after drying for a few minutes directly over a flame turned low. The weight of insoluble chlorides actually obtained in this manner is to be corrected by the addition of 0.00041 gram for every 10 cm.^{3} of amyl alcohol in the filtrate, exclusive of washings, if the insoluble salt is entirely sodium chloride, 0.00051 gram for every 10 cm.^{3} if potassium chloride constitutes the residue, and if both sodium and potassium chlorides are present, 0.00092 gram; but * * * the entire correction may in any case be kept within very narrow limits if due care be given to the reduction of the volume of residual alcohol before filtration. The filtrate and washings are evaporated to dryness, treated with sulphuric acid, the excess of the latter driven off, and the residue ignited to fusion and weighed. From the weight thus found the subtraction of 0.00050 gram is to be made if sodium chloride constitutes the precipitate, 0.00059 gram if potassium chloride alone is present in the residue, and 0.00109 gram if both these chlorides are present, for every 10 cm.^{3} of filtrate, exclusive of washings.

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[1] Precht (Zeitschr. für anal. Chemie, Vol. XVIII, p. 513, 1879) claims that this is to be preferred to 80 per cent alcohol, especially if evaporation has been carried to dehydration of the sodium salt. Atterberg disputes this final statement and says that 80 per cent alcohol gives better results.

[2] When haste is not an object, this way of Bunsen's for removing platinum from the chlorides of the alkalies is by far the neatest and most satisfactory. The small flask containing the solution is placed in a water bath and attached to a hydrogen generator. After expelling all air the flask is closed, without breaking connection with the generator, and left to itself, except for occasional light shaking up, till reduction is accomplished. A more expeditious and very satisfactory reduction is effected by evaporating the solution to dryness with metallic mercury, then heating to expulsion of the excess of mercury and of its chloride (Sonstadt, Jour. Chem. Soc., LXVII, p. 984, 1895), who thus reduces potassium-platinic chloride in order to weigh its platinum.

[3] Proc. Am. Acad. Arts Sci., p. 177, 1886; Bull. U. S. Geol. Survey No. 42, p. 73, 1887; Chemical News, Vol. LV, pp. 18, 29, 40, 56, 78, 1887; Am. Chem. Jour., Vol. IX, p. 33, 1887.

Amyl alcohol is not costly, the manipulations of the process are easy, and the only objectionable feature—the development of the fumes of amyl alcohol—is one which is insignificant when good ventilation is available.

The process has been used for some months frequently and successfully, by others as well as by myself, for the estimation of lithium in waters and minerals.

SEPARATION OF ALKALIES BY OTHER METHODS.

When, as may happen in rare instances, it is necessary to estimate alkalies in the main portion after elimination of silica, alumina, lime, etc., in one of the usual ways, the question of a suitable method for separating magnesium becomes important.

The mercuric oxide method.—The old barium-hydroxide method is not to be recommended. The mercuric oxide method of Zimmermann, whereby the magnesia is precipitated from solution of the chlorides by moist, freshly precipitated, and alkali-free mercuric oxide, can give satisfactory results. The oxide is added in excess to the solution in a platinum crucible and evaporated to dryness. Then the mercuric chloride and most or all of the excess of oxide are expelled by cautious heating. On leaching with water the magnesia remains on the filter. With more than 1 per cent of magnesia the operation must be repeated (Dittrich).

The ammonium carbonate method.—Lately the once favored method of precipitating the magnesium by neutral ammonium carbonate in concentrated solution has been again recommended.[1] The magnesium solution must be as strongly concentrated as possible, and a great excess of ammonium carbonate solution must be used. A voluminous precipitate forms, which dissolves on vigorous stirring if enough of the precipitant was used. After a time a crystalline precipitate falls—a double carbonate of magnesium and ammonium—which is insoluble in a concentrated solution of ammonium carbonate. Allow to stand for six to twenty-four hours. Wash with the concentrated ammonium carbonate solution. It is probably no exercise of undue caution to redissolve and reprecipitate, to make sure of getting all alkali in the filtrate.

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[1] Wülfing: Ber. deutsch. chem. Gesell., Vol. XXXII, p. 2214, 1899. The neutral carbonate is prepared by dissolving 230 grams of ammonium carbonate in 180 cubic centimeters of ammonia of 0.92 specific gravity and enough water to make 1 liter.

The amyl alcohol method.—Under certain circumstances, notably absence of lithium, the method of Gooch developed by Riggs[1] may be satisfactory. It is similar to that of Gooch for separating lithium from sodium and potassium chlorides by amyl alcohol, and involves the same solubility corrections for the alkali chlorides above noted (p. 100) in the description of Gooch's method. Riggs's summary is as follows:

> Evaporate the solution nearly or quite to dryness. Dissolve the residue in as little water as possible and add a few drops of hydrochloric acid. Then add 30–40 cubic centimeters of amyl alcohol and expel the water by bringing the alcohol to boiling. Continue the boiling until the volume of the solution is reduced to 10 cubic centimeters, or even considerably less. In filtering, it is of great advantage to use a perforated crucible and an asbestos felt and to filter under pressure. In case the total chlorides exceed 0.2 grams it may be advisable to decant the liquid, wash the residue, redissolve, and repeat the precipitation. If this be not done, the precipitate should be redissolved with the least possible quantity of water, a few drops of hydrychloric acid added, and the precipitation repeated in the original solution. The filtrate is transferred to a weighed platinum dish and evaporated. Water is added before the alcohol has been expelled, and the evaporation continued. The residue is dissolved in water. Sulphuric acid is added in slight excess. This solution is evaporated to dryness, the residue ignited and weighed, and the treatment with sulphuric acid is repeated. The residue of insoluble chlorides may be transferred to the weighed perforated crucible and dried at a temperature below their melting points, or it may be dissolved and the solution transferred to a weighed platinum dish, evaporated, and the residue dried as above and weighed.

As with the Gooch method for lithium, the numerous test results are good.

XXI. CARBON DIOXIDE, CARBON.

For this estimation an apparatus (fig. 15) permanently set up is used, of which several forms have been described by different writers. The rock powder is boiled with dilute hydrochloric acid in a small Erlenmeyer flask, attached to an upward-inclined condenser, whence, after passing through a compact arrangement of drying tubes—first, one of calcium chloride, then one of anhydrous copper sulphate to retain hydrogen sulphide from decomposable sulphides and any hydrochloric acid that may pass over, and finally a second calcium chloride tube—the carbon dioxide is retained by absorption tubes filled with soda-lime followed by calcium chloride. Of course arrangement is made for a current of CO_2-free air with which to sweep out the apparatus before and after the experiment, and for a slow current during its continuance. The results are very accurate and the determination can be quickly carried out.

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[1] Am. Jour. Sci., 3d series, Vol. XLIV, p. 103, 1892.

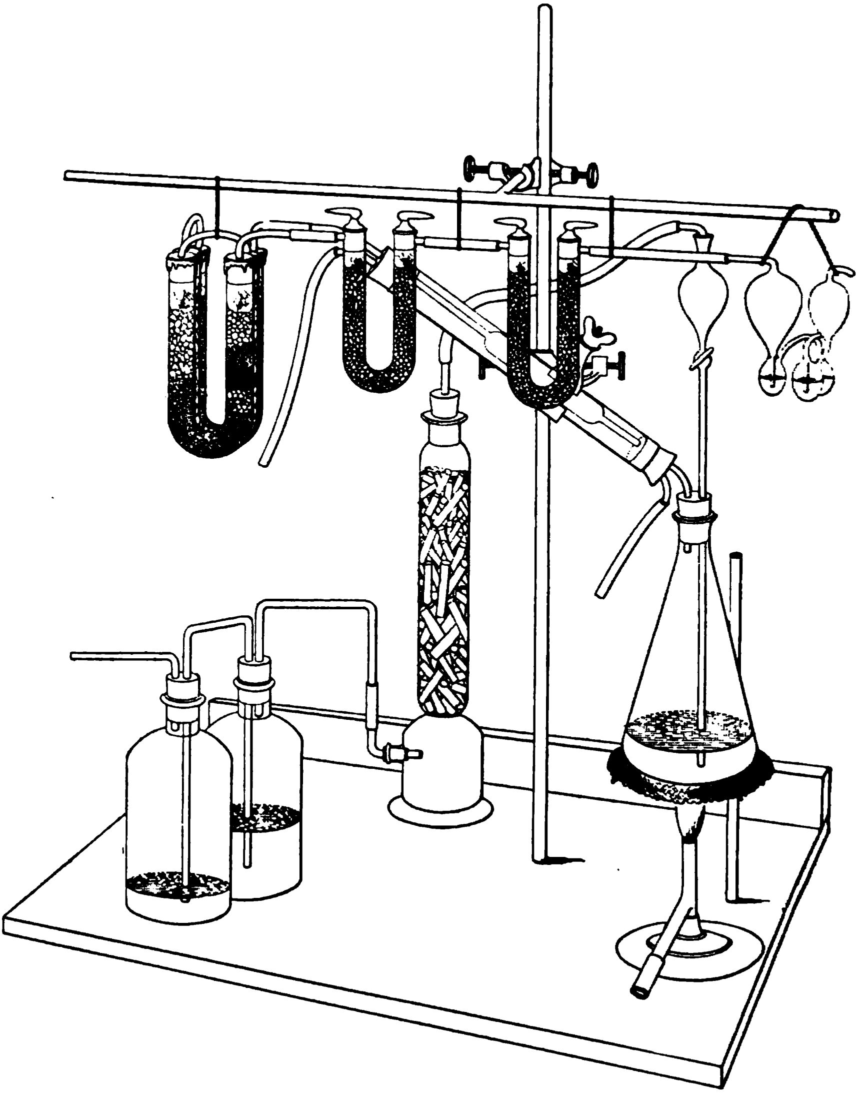

FIG. 15.—Compact form of apparatus for estimation of carbon dioxide.

In the preliminary qualitative test for carbon dioxide, it must be remembered that while calcite gives off its carbon dioxide on treatment with cold acid, dolomite and siderite do not, and hence warming should not be omitted; otherwise, a few tenths per cent of carbon dioxide can very well be overlooked. Moreover, the powder should first be stirred up with a little hot water, to remove all entangled air which might otherwise be mistaken for carbon dioxide.

It has been already shown under Water (p. 45) how, in case of need, the determination of carbon dioxide can be combined with that of water by fusion with lead chromate or potassium chromate. This latter method must always be resorted to when the carbon of graphite or carbonaceous matter has to be estimated. If carbonates are present at the same time the result of the test includes the carbon from both sources, and a separate determination by the wet way of that of the carbonates is necessary.

XXII. CHLORINE.

To make sure of getting all the chlorine, it is best to fuse with chlorine-free sodium-potassium carbonate, or even sodium carbonate alone, first over the full burner, then for a moment or two over the blast, leach with water, acidify with nitric acid, and precipitate by silver nitrate without preliminary separation of silica. If 1 gram of material has been used no precipitation of silica need be feared on acidifying or on standing.

In many cases it is quite sufficient to attack the powder by chlorine-free hydrofluoric acid and a little nitric acid, with occasional stirring, and after filtering through paper fitted into a large platinum cone or rubber funnel, to throw down the chlorine by silver nitrate. The presence of nitric acid is necessary, since otherwise ferrous fluoride reduces silver nitrate with deposition of crystallized silver. When coagulated by heating and stirring, the precipitate is collected on the filter, washed, dissolved by a little ammonia, and reprecipitated by nitric acid, when it can be collected in a Gooch crucible and weighed, or, if very small in quantity, on a small paper filter, which is then dried, wound up in a tared platinum wire, and carefully ignited. The increased weight of the wire is due to the metallic silver of the chloride which has alloyed with it.

XXIII. FLUORINE.

Fluorine can only be estimated by the method of Rose, care being taken to use sodium-potassium carbonate as a flux, and to avoid use of the blast if possible. For minerals rich in fluorine and low in silica it may be necessary to add pure silica before the fusion in order to effect complete decomposition of the fluoride just as with the alkaline-earth phosphates. To the hot aqueous extract several grams of ammonium carbonate are added and more on cooling. After twelve hours the solution is filtered, ammonium carbonate is expelled, and an ammoniacal solution of zinc oxide added, whereupon evaporation is carried on till the odor of ammonia is entirely gone. After filtering add nitric acid in insufficient quantity to fully neutralize.

The use of ammonium nitrate or chloride, instead of carbonate, for throwing out the silica and alumina is not to be recommended, because of loss of fluorine on evaporation (Rose). If the rocks are very basic it may happen that the amount of silica in the alkaline solution is so small that ammonium carbonate may be dispensed with and the ammoniacal zinc oxide solution added at once.

By whatever modification of the method the silica and alumina may have been separated, the alkali carbonate must be converted into nitrate and not chloride if phosphorus or chromium, or both, are present. To remove the chromium and the last of the phosphorus, silver nitrate in excess is added to the solution containing still enough alkali carbonate to cause a copious precipitate of silver carbonate, which shall take up the acid set free and thus insure a neutral solution and consequent complete precipitation of phosphorus and chromium. After heating and filtering, the excess of silver is to be removed by sodium or potassium chloride, and sodium carbonate is to be added, in order to furnish by addition of calcium chloride in excess to the hot solution a sufficient admixture of calcium carbonate with the fluoride. At this stage there must be no ammoniacal salts in solution, otherwise calcium fluoride may be held up.

The next operation is perhaps best conducted as recommended by Penfield and Minor.[1] To the gently ignited precipitate of carbonate and fluoride of calcium at most 1–2 cm.^{3} of acetic acid are added in the crucible, which is then placed for a time on the water bath and afterwards its contents are evaporated to dryness. They are then taken up with hot water, the solution is decanted through a small filter, likewise the washings. The filter is burned in the same crucible, more acetic acid is added and the various operations are repeated until all calcium oxide and carbonate have been extracted. The above authors find that if a great excess of acetic acid is used at the start, the results are low. While their experiments related to the determination of fluorine in a mineral rich in that element—topaz—their precautions are probably not needless with the small amounts of fluorine met with in rocks.

The well-washed and gently ignited calcium fluoride finally obtained in the course of this method should be converted to sulphate as a check upon its purity, and at the same time as a qualitative test to ascertain if it really is calcium fluoride by the characteristic odor of the gas given off. Should fluorine be found, and the weight of sulphate not correspond to that of the fluoride, the former should be dissolved in not nitric acid and tested for phosphorus by ammonium molybdate solution. If phosphate is absent the impurity may have been silica or calcium silicate—which of these it would be difficult to decide. In the former case the fluorine might be safely deduced from that of the sulphate, but not in the latter. If the rock were rich in sulphur it might happen that calcium sulphate would be thrown down with the fluoride, but this should be removed by thorough washing. If not, and it were certainly the only impurity present, the fluorine could be calculated, after conversion of the fluoride into sulphate, by the formula:

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[1] Am. Jour. Sci., 3d series, Vol. XLVII, p. 389, 1894

$$CaSO_4 - CaF_2 : 2\ F :: \text{Diff. between impure } CaSO_4 \text{ and } CaF_2 : x.$$

It is an exceptional case when there is exact agreement between the weight of fluoride and sulphate, and with the small amounts usually met in rocks the error may be an appreciable one in percentage of fluorine, though of no great significance otherwise.

There is no qualitative test which will reveal with certainty the presence of fluorine in rocks. Heating the powder before the blowpipe with sodium metaphosphate on a piece of curved platinum foil inserted into one end of a glass tube, or in a bulb tube, is not to be relied on in all cases. While as little as one-tenth of 1 per cent of fluorine can sometimes be thus detected with ease, much larger amounts in another class of rocks may fail to show.

XXIV. SULPHUR.

Before proceeding to the estimation of sulphur, its condition, if present, should be ascertained.

Evolution of hydrogen sulphide on boiling with hydrochloric acid is evidence of a soluble sulphide, usually pyrrhotite, but possibly lazurite. Extraction of magnetic particles reacting for sulphur shows pyrrhotite to have been in part at least the source of the hydrogen sulphide. A reaction for sulphuric acid in the filtered solution indicates a soluble sulphate, usually noselite or hauynite. If the residue, when well washed and treated with aqua regia or hydrochloric acid and bromine, gives more sulphuric acid, the probable presence of pyrite is shown. Should this solution likewise show arsenic, the sulphide may be arsenopyrite, which, however, is of very rare occurrence in igneous rocks, if, indeed, it is ever found there.

For the quantitative extraction of the sulphur of soluble sulphates, simple boiling with hydrochloric acid suffices, which should be done in an atmosphere of carbonic acid if pyrites or other oxidizable sulphides are present, and should be finished as quickly as possible in order to minimize the error resulting from oxidation to sulphuric acid of the sulphur of sulphides, if present, by any ferric salts that may have been dissolved.

The sulphur of sulphides may sometimes be correctly determined by extraction with aqua regia or some other powerful oxidizer. But not always; so that it is better by far to fuse with sulphur-free sodium carbonate and a little niter over the Bunsen burner, and for a few moments over the blast, fitting the crucible into a hole in asbestos board (Lunge) to prevent access of sulphur from the flame. After thorough disintegration of the fusion in water, to which a drop or two of alcohol has been added for the purpose of reducing manganese, the solution is filtered and the residue washed with a dilute solution of sodium carbonate. In the filtrate (100–250 cm. bulk) the sulphur is precipitated at boiling heat by barium chloride in excess after slightly acidifying by hydrochloric acid. Evaporation to dryness first with acid, in order to eliminate silica, is needless, for in the above bulk of solution there will almost never be the least separation of silica with the barium sulphate. It is well that this is so, for evaporation on the water bath heated by gas to remove silica would in many cases involve an error fully equal to the sulphur present by contamination from the sulphur of the gas burned.

Owing to the small amount of sulphur in rocks, special purification of the barium sulphate obtained is hardly ever needful, especially as it has been precipitated in absence of iron. Should there be fear of a trace of silica being present, it can be removed by a drop of hydrofluoric and sulphuric acids before weighing the barium sulphate.

This, of course, gives the total sulphur in the rock. If soluble sulphates and sulphides as well as insoluble sulphates and sulphides are present together, the sulphur of the first is found in solution after extraction by hydrochloric acid in a carbon-dioxide atmosphere, and that of the decomposable sulphides by collecting the hydrogen sulphide evolved.[1] In the residue the sulphur of the insoluble sulphides can be estimated, or from the total sulphur found in another portion its amount can be calculated. The error involved in the above estimation of the sulphur of soluble sulphides, due to the possible reducing effect of hydrogen sulphide on ferric salts, is probably negligible. Most of the hydrogen sulphide would be expelled before any such action could take place and probably before the ferric salts were largely attacked, but of course the small proportion of sulphur set free as such from pyrrhotite would escape estimation and introduce further uncertainty. In general, it would be safe enough to assume the composition Fe_7S_8 for pyrrhotite. However carefully all these separate determinations may be carried out, the final figures for ferrous and ferric oxides can hardly be regarded as more than approximations when much sulphide is present. (See pp. 94–95.)

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[1] With pyrrhotite a small fraction of its sulphur—one-eighth if the formula Fe_7S_8 is adopted—is liberated as free sulphur and not as hydrogen sulphide.

XXV. BORON.

To the best of the writer's belief, it has never been found necessary in this laboratory to estimate boron in a silicate rock. Should the determination be required, since most silico-borates are insoluble minerals, it would probably be necessary to fuse with sodium carbonate, extract with water, faintly acidify with nitric or acetic acid, expel the boron by distillation with methyl alcohol, and collect the boric ether in a suitable manner. For simple borates, artificial or native, this method,[1] first devised by Rosenbladt and Gooch independently, gives entire satisfaction when all needful precautions are carefully observed, but its application to boro-silicates yet needs investigation, in view of the as yet unexplained very discordant results obtained some years ago by J. E. Whitfield in this laboratory on the mineral warwickite, a boro-titanate of magnesium and iron.

It is also quite possible that the accurate estimation of but a few milligrams or even less of boric oxide by the use of a large excess of lime as a retainer would not be feasible. Fluorine would have to be first removed by calcium nitrate or acetate before freeing the boron.

XXVI. NITROGEN.

Nitrogen has been found in igneous rocks or the minerals occurring in them by several observers. Thus, H. Rose[2] says that pitchstone gives off ammoniacal water on heating; Silvestri[3] mentions a nitride of iron in lavas from Etna; Sandberger finds ammonium carbonate to be given off from certain rocks of Pribram; the writer has shown nitrogen to exist in uraninite; Ramsay and others have noted it in traces with or without helium, etc., in numerous minerals; and later Erdmann[4] found it to be given off as ammonia on treating various minerals of "ancient igneous rocks" with a caustic alkali. Luedeking also found ammonium sulphate in a barite from Missouri, the presence of which the writer was able to confirm.

It has been noted in this laboratory on three separate occasions, when series of ores, roofing slates, and eruptive rocks were analyzed, that ammonia, either in the form of chloride or sulphate, or even as free ammonia, was given off on heating. Its appearance was not limited to one or a few specimens of a series, but seemed to be characteristic of all, and to be afforded by the unbroken rock as well as by the powdered sample. The precise conditions under which the specimens were collected not being known, it is impossible to affirm positively that the ammonia may not have been due to recent organic contamination of some sort, especially in the case of the slates, but it is believed that a more critical collection of material will not alter the general result. Its amount was sometimes readily determinable by Nesslerization, being as high as 0.04 per cent in some slates. Carbonaceous organic matter was absent from most of these, but doubtless existed in them in their early history. In their case the ammonia was, in part at least, evolved as such, imparting a strong alkaline reaction to the water in the upper part of the tube. The presence of sulphides, fluorides, or chlorides in the rock might cause the ammonia to appear as a sublimate of sulphate, fluoride, or chloride. Speculation on this matter would be altogether premature, but attention is called to it in the hope that other observers may be led to look for and investigate similar appearances. It should be borne in mind that the nitrogen present would not necessarily appear as ammonia or ammonium salts, since it might be given off in the elemental condition, as with the gases obtained from uraninite.

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[1] Rosenbladt (Zeitschr. für anal. Chemie, Vol. XXVI, p. 21, 1887) used magnesia for binding the boron, while Gooch (Proc. Am. Acad. Arts and Sci., p. 167, 1886; Bull. U. S. Geol. Survey No. 42, p. 64; Chemical News, Vol. LV, p. 7, 1887) preferred lime, as more active and reliable. Gooch and Jones have later (Am. Journ. Sci., 4th series, Vol. VII, p. 34, 1899; Chemical News, Vol. LXXIX, pp. 99, 111, 1899) upheld the use of lime and proposed, as a convenient though perhaps not quite so perfect substitute, sodium tungstate containing an excess of tungstic oxide. In this article they likewise indicate the precautions now used to insure complete collection and retention of the boron.

For a useful modification in the way of collecting the boric ether in ammonia before bringing in contact with the lime, see Penfield and Sperry (Am. Journ. Sci., 3d series, Vol. XXXIV, p. 222, 1887); also Moissan (Comptes Rendues, Vol. CXVI, p. 1087, 1893, and Bull. Soc. Chim., Vol. XII, p. 955, 1894), who modifies the Gooch distilling apparatus in certain respects.

[2] Quantitative Analyse, p. 673. Finkener edition.

[3] Gazz. chim. ital., Vol. V, p. 303, 1875.

[4] Ber. Deutsch. chem. Gesell., Vol. XXIX, p. 1710, 1896.

XXVII. SPECIAL OPERATIONS.

The problem often presents itself of ascertaining the composition of that portion of a rock powder which is soluble in special reagents or in a reagent of a particular concentration. No precise directions can be formulated to meet such cases. The procedure must vary with the character of the constituents of the rock and with the object which it is sought to attain, and only in exceptional cases can a separation of this kind be sharp. Much depends on the degree of fineness of the powder and on the length of time it is exposed to the action of the reagent.

DETECTION OF NEPHELINE IN PRESENCE OF OLIVINE.

For confirmation of the microscopic diagnosis, Prof L. V. Pirsson[1] has indicated a means of detecting nepheline in presence of olivine, as in nepheline basalts, based on the very ready solubility of nepheline, as compared with olivine, when boiled for but one minute with a sufficiency of very dilute nitric acid (1:40). Gelatinization of the filtrate on evaporation is taken as evidence of the presence of nepheline. If olivine is present in quantity, however, this test must not be accepted at once as final, for some, if not all, olivines are much more soluble in nitric acid of the above strength than Professor Pirsson was led to believe from his original tests. If, therefore, on evaporation of the filtrate, much iron is indicated, the gelatinization may well be due to olivine alone or in part, and then the quantitative relation of silica to iron plus magnesium should be ascertained. It must also be borne in mind that any other very soluble silicates present will be more or less affected, and that apatite is largely or wholly dissolved. It is possible that still more dilute nitric, or perhaps some other, acid may exert a slighter solvent action on olivine without being appreciably less effective in dissolving nepheline, etc. In combination with a quantitative analysis of the extract the method is perhaps susceptible of a wider application than the particular case for which it was first used. It is well worth further study.

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[1] Am. Jour. Sci., 4th series, Vol. II, p. 142, 1896.

ESTIMATION OF SOLUBLE SILICA.

Very often in treatment by acids silica is separated in gelatinous or granular form mixed with the unattacked minerals, and it becomes necessary to remove or estimate this silica, or else to discriminate between soluble and insoluble silica already existing together. Usually a boiling solution of sodium carbonate has been employed for this purpose, though the caustic alkalies have found advocates.

Lunge & Millberg[1] have lately conclusively shown that quartz is not nearly so insoluble in solutions of the caustic alkalies as has been supposed, but that given a sufficient degree of subdivision it can be brought wholly into solution; that it is impossible to secure correct separation of quartz and opaline silica by the use of either caustic or carbonated alkalies; and that digestion on the water bath for 15 minutes with 5 per cent solution of sodium carbonate is the only way to secure exact separation of unignited precipitated silica from quartz, and then only when the finest flour has been removed by levigation. The authors say:

> If, however, no more of such flour is present than is produced in the ordinary operations of powdering and sifting through cloth of the finest mesh, the error arising from the above mentioned treatment is so slight that it can generally be neglected; it reaches 0.1 to at the most 0.2 per cent of the total silica, by which amount the quartz will appear too low, the amorphous silica too high.

The above authors also show, however, that the solvent action of the caustic alkalies on quartz becomes very apparent only when the material has been reduced to such an utterly impalpable degree of fineness as is practically never reached in the preparation of samples for rock analysis. For this reason I have no hesitation in recommending the employment of a dilute solution of sodium hydroxide when the silica separated by acid from one of several mineral constituents of a rock is to be estimated. Even when dilution is considerable, solution is almost immediate, and as soon as this is accomplished—the point being known by the change in appearance of the residue—the solution should be diluted with cold water and filtered at once. The difficulty met with in filtration may often be overcome by faintly acidifying, which has the added advantage of at once arresting any further action of the alkali. If the dilution is sufficient no separation of silica results from so doing. Very dilute acid should also be used for washing. Lunge, when using sodium carbonate, washes with hot carbonate solution to which alcohol has been added, thus obtaining clear filtrates.

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[1] Zeitschr. für angewandte Chemie, 1897, pp. 393, 425.

XXVIII. ESTIMATION OF MINUTE TRACES OF CERTAIN CONSTITUENTS.

If, as sometimes may happen, the problem is presented of examining rocks for traces of gold, silver, and other elements which are not ordinarily looked for, as in Sandberger's investigations bearing on the origin of the metalliferous contents of veins, large weights of material must be taken, up to 50 grams or more. This involves the use, also, of large quantities of reagents, the purity of which must then be looked to with the utmost care. Special directions to meet such cases can not now be given, nor even a complete reference list of the scanty and scattered literature on this subject. Sandberger's own writings deal but little with its analytical side, and from its inaccessibility in the Washington libraries the writer is as yet unacquainted with the report by Von Foullon "Ueber den Gang und die Ausführung der chemischen Untersuchung,"[1] following Sandberger's own paper in the general report "Untersuchungen der Nebengesteine der Pribramer Gänge."[2] The present writer has published a few data as to gold, silver, lead, zinc, etc.,[3] in Mr. S. F. Emmons's report on "The Geology and Mining Industry of Leadville;" and Mr. J. S. Curtis,[4] in his report on "The Silver-Lead Deposits of Eureka, Nevada," has given his method of assaying rocks for traces of gold and silver.

To Prof. F. W. Clarke and Dr. H. N. Stokes the writer's thanks are due for friendly suggestions in the preparation of the foregoing work.

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[1] Jahrbuch der Bergakademie, Leoben u. Pribram, 1887, p. 363.

[2] From Sandberger's report it appears that the rocks were treated successively with water, acetic acid, boiling dilute hydrochloric acid for two days, and finally hydrofluoric acid, the several extracts and final residue of fluorides (and pyrite) being separately examined for heavy metals. The products of distillation were also examined. A striking fact observed in all cases was the complete insolubility of the pyrite, even after the severe treatment mentioned. This speaks strongly in favor of the correctness of ferrous iron estimations in silicates by the hydrofluoric and sulphuric acid method when pyrite is present unaccompanied by other sulphides. (See p. 95.)

[3] Mon. U. S. Geol. Survey, Vol. XII, Appendix B, pp. 592-596, 1886.

[4] Mon. U. S. Geol. Survey, Vol. VII, pp. 120-138, 1884.

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